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6 APRIL 1987

# China Report

SCIENCE AND TECHNOLOGY

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CHINA REPORT  
SCIENCE AND TECHNOLOGY

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NATIONAL DEVELOPMENTS

TOP ACADEMY OF SCIENCE OFFICIALS DISCUSS LEADERSHIP CHANGES

Beijing KEJI RIBAO in Chinese 26 Jan 87 p 1

[Article by Liu Zhida [0491 1807 6671] of GUANGMING RIBAO and Du Mingming [2629 2494 2494] of this paper: "Everything Is for the Development of the Chinese Academy of Sciences; Lu Jiaxi, Yan Dongsheng and Zhou Guangzhao Discuss Changes in the Academy's Leadership"]

[Text] On 24 January at 4 p.m., in the comfortable offices of the President of the Chinese Academy of Sciences (CAS), reporters met with the famous scientists Lu Jiaxi [4151 0857 6932], Yan Dongsheng [0917 2639 3932] and Zhou Guangzhao [0719 0342 0664]. These men are currently studying the CAS' reform plans.

Reporters asked for a briefing on the situation regarding the most recent CAS leadership changes.

Yan Dongsheng said, "I happen to be participating in the meetings of the State Science and Technology Committee, so will say a bit about that. Jiaxi and I came to Beijing in February 1981, to start work at the CAS, he as president and I as vice-president. As for CAS reforms and evolution, and building a spiritual civilization, we have been doing those things which had to be done for 6 years now."

Yan Dongsheng received his doctoral degree in the United States in the 1940's. He is a noted chemist and materials scientist, who maintains a scholarly bearing at all times. In 1950 he decided to abandon the more advantageous situation in the United States and returned to China to serve. After a few years, he assumed the post of Director of the Shanghai Silicate Institute, and was awarded the National Innovation Award First and Second Class, and the Natural Science Award. Last year he was awarded honorary Doctor of Science degrees by the University of Illinois and the Universite de Bordeaux in France.

Yan Dongsheng said, "We were appointed to serve on a temporary basis, and 6 years have now flashed past. During this time, I grew to understand the guiding policies of central authorities concerning S&T's essential role in

economic construction. I also tried my utmost to implement these policies, which were to move forward in transforming S&T results into production forces. But reform is a long-range process, with a great deal of work yet to be done. Therefore, we advocated all along that at some early stage, we should begin letting middle-aged comrades assume important responsibilities. Now, my responsibility has shifted to Guangzhao. Guangzhao has been our colleague for several years, and there is complete mutual understanding. He is very competent, and we believe that he and the new groups will definitely instill even greater vitality into the CAS, in accordance with central policies. From this point on, I am pulling back to the second rank of positions, and giving up my administrative responsibilities, because there is just no way for someone in an administrative position to take it easy. Since I came back to China over 30 years ago, my work and my life have all along been intertwined with the nation's scientific work, and with the CAS. No matter what the post is, there can be no letup. From here on, we can go on as always, trying as hard as we can to support and assist Guangzhao and our other comrades in moving forward the work of the CAS."

Continuing, Lu Jiaxi said, jokingly, "I am now 71.2 years of age, and Dongsheng is 68.9, so the two of us average a little over 70 years old, and for someone to live for 70 years has always been the exception. The CAS has more than 120 research institutes and more than 80,000 employees; when one gets as old as we are, the spirit is lacking for handling so extensive an organization. Dongsheng and I discussed this often last year. We want to let our comrades in their middle years move into the top echelons, while we drop down to the second rank, and report to a central authority. This adjustment in the CAS leadership has been under discussion for a long time, and is quite normal. However, there has been some outside conjecture which is not in accord with the facts of the situation. My daughter called me long distance early yesterday morning to ask what was going on: I told her 'There's nothing going on; everything is normal here.'"

When he had finished speaking, Lu Jiaxi smiled, the straightforward, sincere smile of an elder. A portly man, he was dressed in a dark blue Chinese tunic suit, his greyish white hair noticeably thinning. Patting his expanded belly, he said, "I received my doctorate in physical chemistry from the University of London in 1937. I went to the United States after that, and at the end of the Anti-Japanese War in 1945, I returned to China. As for my stepping down from my position, I raise both my hands in approval. In the years of life left to me, I am determined to do all that I can to continue building the CAS, to make it even more useful in building the economy, and to continue working hard." Lu Jiaxi went on to say, "Comrade Ghangzhao was appointed a vice president of the CAS in 1984. He is more than 10 years younger than we are, just entering the prime of life. He is a well-known particle physicist, who has organized quite a few S&T projects on key problems. We see his appointment to the presidency as an outstanding one."

Zhou Guangzhao spoke highly of the work of Lu Jiaxi and Yan Dongsheng during their tenure as CAS leaders, and of their contributions to reform of the CAS. He said that they stressed building a spiritual civilization relatively early.

From 1985, Lu and Yan as elders had on several occasions expressed criticisms of the mistakes of Fang Lizhi [2455 0536 0037]. Comrade Dongsheng had recently represented the CAS in the party leadership discussions of Fang Lizhi, attempting to help him recognize his errors. Zhou Guangzhao said, "Reform is at the center of the CAS' mission. Under the direction of these two elders, we have drafted a plan for moving forward with reforms and strengthening our building of spiritual civilization; from start to finish, our work will follow the path they have laid out for us."

Finally, showing considerable emotion, Zhou Guangzhao told the reporters, "I have been working for 2 years now with these two senior scientists, and have learned a great many things at their side. Their conscientious teaching and dedicated spirit have earned them the respect of everyone. The new party leadership has asked them to take on new roles as special consultants to the CAS. In the days to come, there will be a great deal of work inside the CAS which will be entrusted to these two, and major policy decisions for which we will still seek their counsel."

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CSO: 4008/2062

## NATIONAL DEVELOPMENTS

### PROGRAM URGED FOR SENDING STUDENTS ABROAD

Beijing KEJI RIBAO in Chinese 26 Jan 87 p 2

[Article: "Chinese Scholars on Visit to the United States Regard the Development of Scholarly Leaders as the Major Goal of Sending Personnel Abroad for Study"]

[Text] The S&T Section of the Chinese Embassy to the United States recently invited six visiting scholars to an informal discussion of problems involved in the training and supervision of S&T personnel. After analyzing China's research force and the current level of research in China, the participants called for the adoption of certain measures aimed at speeding up the development of leaders in China's various scholarly fields.

These people held that, at present, China's foremost scholars are prestigious older professors and scientists. Most of these people acquired academic degrees abroad, then stayed on there to teach and do research for some years. They did not return to China until they were capable of directing departments, so they were of a somewhat higher level. At present, due to a lack of truly front-rank scholars, many units are assigning important positions to personnel whose research and teaching is of a lower level. This in turn influences the graduate students they produce. So it becomes a matter of the utmost priority to adopt those urgent measures which will accelerate the development of a group of research and teaching leaders who will bring to their jobs both fresh learning and strong capabilities.

In order to do a good job of developing these research and teaching leaders, we should adhere to the principle of "linking the advantages and disadvantages," according to the plans and needs of China's national economic development. The work of sending people abroad should be done in a purposeful, planned and measured way. The first step will be the selection of outstanding people to be sent abroad, taken from the existing pool of young and middle-aged research and teaching personnel. These people will have a program drawn up which clearly sets out their advanced study objectives. There should be regular checkups and strict standards for these personnel, and they should be critically reviewed and assessed upon their return to China. The length of time spent in advanced study should be decided on an individual basis, based upon the

requirements of the individual's study program and the facts of the individual case. The second step is to deal with the long-term arrangement: this will involve the selection of outstanding people from each year's group of graduates, who will be sent abroad to pursue master's and doctoral degrees, as well as "post-doctoral" study. After they have the capability of taking over departments, they will return to China. Some may stay on overseas for awhile to work. Throughout, there will be an emphasis on caring for these people, aiding them in resolving their study situations, and in overcoming any difficulties.

In order that a group of scholarly leaders who can measure up to standards is developed as quickly as possible from the personnel sent abroad, it is further recommended that:

1. Those domestic units which send people abroad should increase their professional mentoring of overseas students, setting forth clear-cut goals for their studies.
2. The state should publish its personnel requirements at regular intervals among the overseas visiting scholars and students, so that the latter may make adjustments in study programs necessary to conform to national needs.
3. We must integrate programs for personnel development and construction with our research and teaching programs, bringing scholars who are visiting or studying abroad in line with specific domestic research and teaching programs. This should be done in conformity with plans for recalling these personnel in their turn, which will facilitate bringing them into full play.
4. We should strive to turn research projects worked on during the period of advanced study into projects which can be cooperative ventures between units sending personnel and overseas units, which can continue over an extended period of time.
5. When personnel have completed their studies and returned to China they should be assigned to work which is suited to their abilities, smashing the view which rewards seniority over ability. Outstanding staff should be able to skip grades in promotion, work out problems independently, and take on graduate students of their own.

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NATIONAL DEVELOPMENTS

LI PENG ON ASSIGNMENT OF PRC STUDENTS ABROAD

Beijing RENMIN RIBAO OVERSEAS EDITION in Chinese 25 Oct 86 p 1

[Article by Wang Jinhe [3769 6855 0735]: "Li Peng With American Scholars on Assignment of PRC Students Abroad"]

[Text] Beijing, 24 Oct (XINHUA)--Vice Premier and chairman of the State Education Committee, Li Peng told a number of visiting American scholars at Ziquang Pavilion in Zhongnanhai today that China will adjust its policy on sending students and visiting scholars abroad based on its needs in the modernization effort.

Li said that China needs a large number of people in applied science and management. However, there are not enough people studying in these areas among those abroad. Some areas being studied and investigated are not closely related to the needs in the four modernizations.

Li wishes that American scholars help PRC students in the United States to have an opportunity to study in business and research organizations.

When talking about exchanges in social science, Li pointed out that it is wrong to believe that advanced technology and management concepts can only be learned by adopting the entire western system of culture and ideology. Similarly, it is equally wrong to learn technology and management skills alone from the west and not to learn western culture and arts at all.

He said that as we are learning advanced technology and management experience from the west, good aspects in the western culture can also be studied. To this end, China will appropriately assign more people in social science to study abroad in order to strengthen the academic exchange between China and other countries in this area.

Li stresses that sending students and visiting scholars abroad will remain a part of China's open door policy in the future.

China has over 30,000 students abroad, more than one-half of them in the United States.

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## NATIONAL DEVELOPMENTS

### PLANS FOR S&T LEGISLATION IN 7TH 5-YEAR PLAN DISCUSSED

Tianjin JISHU SHICHANG BAO in Chinese 16 Sep 86 p 1

[Article by Duan Ruichun [3008 3843 2504], assistant chief of the Policy Bureau of the State Science Commission: "Establishing Appropriate S&T Legislation for China; On S&T Legislation in the Seventh 5-year Plan"]

[Text] S&T legislation is an important part of socialist legislation work in China. In the present stage of S&T system reform and during the seventh 5-year plan, the mission of S&T legislation is to formalize the basic principles and major policies of the government and the CPC in S&T in order to adjust the social relationship between government, corporation and individual citizen in S&T activities based on modern development patterns, to accelerate progress, and to encourage S&T to serve economic construction and social development.

Last August, the State Science Committee and the Education and Culture Committee of the People's Congress jointly held the first S&T legislation workshop. We entered a new era in the establishment of a socialist legal system in China. In the past year, under the support of the People's Congress and the legal department of the State Council, in coordination with the implementation of the seventh 5-year plan, the State Science Committee and other relevant departments began legislative survey and drafting of over 20 S&T laws and administrative regulations. Some preliminary progress was made.

In terms of legislation, the "Technology Contract Law of the People's Republic of China" which was drafted by the State Science Commission and 34 other departments is being refined. It has already been included in the agenda to be reviewed by the Standing Committee of the People's Congress and the State Council for this year. This is a law which adjusts the legal rights and obligations between corporations and individuals in technology development contracts, technology transfer contracts and technology service contracts. It will prompt the implementation of the strategic policy that "economic construction must depend on S&T, and S&T must serve economic construction." It will also push the reform and four modernizations forward. In addition, the State Science Commission and the Chinese Science Association are drafting the "Scientific and Technological Organization Act of People's Republic of China." The Nuclear Safety Bureau of the State Science Commission and the Ministries of Nuclear Industry, Machine Building and Hydroelectric Power have also presented a draft for the "Nuclear Power Act of People's Republic of China." They are in the process of being refined and supplemented. In order to meet the needs in the reform of the S&T system in China, the State Science

Commission and nearly 20 other organizations are studying and drafting the "Science and Technology Research Act of the People's Republic of China." Through this piece of legislation, the legal position of research institutes can be defined. The legal rights of a research institute can be protected. The organization, S&T system, rights and obligations of a research institute will be prescribed. Thus, the fundamental legal system for research and development will be established in China.

In the area of administrative regulations, six sets of regulations associated with the "decisions on the reform of S&T system by the Central Committee of the Chinese Communist Party" have been drafted. Among them, the "Temporary Regulations on the Establishment of Natural Science Foundation Committee," "Temporary Regulations on Managing S&T Funding," and "Temporary Regulation on Expanding the Autonomy of S&T Research Institutes" have been issued by the State Council. The three remaining ones are under review by the State Council. Four nuclear safety related regulations were also approved by the State Council to ensure the safe operation of China's growing nuclear power facilities. They are issued by the Nuclear Safety Bureau of the State Science Commission. In addition, there are more than a dozen administrative regulations which are being drafted, modified and perfected.

In the area of theoretical science, the State Science Commission included S&T legislation study into the national theoretical science projects last November. It organized 19 items including the worldwide comparison of S&T legislation, legislative investigation of the new technological revolution, technology transfer contracts, technical service contracts, the theory of technology, technology import and export, and licensing system. Nearly 200 technical and legal experts from over 20 research institutes, universities and organizations are exploring a S&T legislation plan to coordinate the effort with the seventh 5-year plan. They are pioneering important S&T legislation. These studies will have a significant contribution to making the S&T legislation policy more democratic and scientific.

The S&T law in China is still in its infancy. Under the guidance of "taking care of construction and legislation at the same time," in order to create a strategy for S&T legislation that conforms with the reality in China, the State Science Commission is working on the overall plan for the entire period of the Seventh Five Year Plan to ensure the initiative, foresight and scientific nature of S&T legislation. The guiding ideology of S&T legislation in the seventh 5-year plan in China should be the gradual perfection of the S&T legal system and re-deployment to reflect S&T reform, centered around the development strategies laid out for the period. It is planned that after the 5-year effort we can preliminarily set up a S&T legal system based on fundamental S&T legislation, important S&T laws and administrative regulations to provide a legal basis for the management system, planning system, intellectual work, results management, technology market, basic facilities, implementation of projects, exploration of new technology, and international collaboration and exchange. We want to have a Chinese style S&T legal system to ensure the steady progress in the modernization of S&T.

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## NATIONAL DEVELOPMENTS

### TECHNOLOGY POLICY FORMULATION DISCUSSED

Beijing LIAOWANG OVERSEAS EDITION in Chinese 13 Sep 86 pp 10-11

[Article by Wang Lin [3769 2651]: "In Search of a Chinese-Style Technology System"]

[Text] The first batch of blue books released by the State Science and Technology Commission, (China's Technology Policy), with 12 areas of specialities, was published in 11 volumes. In addition, technology policies in other areas are also being formulated. For example, the technology policy in bioengineering will be determined soon.

#### White Books and Blue Books

Not too long ago, China issued its first S&T whitepaper - (China Science and Technology Guidebook). This book records and analyzes the essence, basis and implementation of every major S&T policy of the Chinese Communist Party and the Government since the 3d Plenum of the 11th CPC Central Committee at the end of 1978. The book consists of seven parts: the first chapter "Historic Evolution" describes China's basic policy and strategy in S&T development, as well as its S&T system reform. In the second chapter entitled "Policy and Legislation," the essence of the technology policies of the 12 fields issued in May is described. The third chapter, "Research and Development," introduces the contents of the development of advanced technology and the "Spark" plan. The fourth chapter is "Commercialization of Technical Accomplishments." The fifth chapter, "Environment and Resources", reveals the basic scope of domestic S&T construction. Chapter 6 is "Statistical Objectives." The final part selectively publishes some important lectures and documents approved by the Government.

The blue book contains three parts. The first part is key points in the technology policy and their explanations. The "key points" are the policies approved by the State Council. It is a policy document of the Government. After approved by the State Council, these policies are implemented throughout China as the basic policy basis for guiding, monitoring and checking the direction of technology development in China. The "explanations" primarily tell us why such choices were made. The second part is the background material used to prove the technology policy. It mainly provides the status of the technology in China, the development goals and future projections.

This is the basis for formulating a technology policy. Based on it, we can determine the gap between and other leading nations in the world. The third part is an abstract of the speeches and recommendations of the experts at the technology policy meeting. This large scale technology policy demonstration already involved over 2,000 experts who offered important opinions from their own fields of expertise.

The technology policy primarily answers four questions: the extent to which each field's development goals have been achieved, the internal structure of each trade, the choice of technology, and the ways and measures to promote progress in technology.

#### Development Goals: Five Categories

In 1982 premier Zhao Zhiyang said that "By the end of this century, we should widely apply advanced production technologies which suit China's needs and are commonly used in developed nations in the 1970's and early 1980's to the factories and mines in China. Furthermore, we should form China's own technology system. This statement is the basis for the overall goal technology development in China. In the proof of policy process, it was recognized by many experts.

Based on this principle, according to the status of each trade and field, different technology development goals were defined. In summary, they can be categorized in five types. These five types are not parallel. They crisscross one another and appear in a trapezoidal arrangement.

-- In most fields, the backbone industries might reach the technical level of developed nations of the 1970's and early 1980's by the end of this century through hard work. For instance, the machine building industry and the materials industrial belong in this category.

-- Some traditional industries (such as textiles and food) and new industries (such as home electronics and microcomputers) should and may reach the 1990 technology level of developed nations. It may even be close to the state of the art by that time.

-- In certain fields, such as transportation, urban electrification, natural gas supply, and communications, it will not be possible to reach the 1970 to early 1980 technology level in developed nations.

-- Certain technology development directions in other countries do not satisfy China's requirements or no longer fit the current trend. We have to open new channels or skip some steps in order to utilize some modern technologies.

-- In the areas where we have unique resources and traditional technology, such as rare earth minerals and Chinese herbal medicine, we should develop our own technology to create China's advanced technology.

## Business Structure: In Search of the Optimal Combination

A business structure includes the technology structure, production structure and product structure of the business. The changes in the business structure can reflect the technological progress of the business.

### Technology Structure

The advantages and disadvantages of various technologies are used to determine the optimal ratio in the business in order to guarantee technology advances and to ensure higher overall profitability. This is the basic principle in the selection of a technology structure. For example, in the debate of the technology policy for railroad towing power, the experts did a thorough investigation on the technological and economic advantages and useful ranges of electric, internal combustion and steam locomotives based on their transport capacities, values, materials objectives and time objectives. Then, based on China's energy policy, condition and ability, a development plan was proposed. On high volume major arteries where improved capacity, energy conservation and economic benefits can be expected, we should promote electric power. On high volume routes with steep slopes and long tunnels, it is also more appropriate to use electric power. Internal combustion engines should be used for dispatching and small scale transport of goods on electrified lines. It should also be used on lines where steam engines are not suited for and electric engines are not economic. On lines with a good supply of water and coal where the growth is slow and the volume is low, steam engines should continue to be used.

### Production Structure

The basic requirement in the selection of a production structure is to use the most advanced production technology possible to form the optimal combination of production technology and scale for higher efficiency. For example, to use a 10 or 100 ton converter in steel production not only involves the volume but also affects efficiency and profitability. In general, China primarily needs to concentrate its production activities in most trades. Large scale industries must be built in key locations. The recently formulated technical policy for the metallurgical industries specifically points out that any new blast furnace must not be less than 1,000 cubic meters, an oxygenated converter must be over 20 tons, no furnace under 20,000 tons in annual capacity will be built, and furnaces under 40,000 tons in capacity will be made obsolete.

### Product Structure

The essential content of the technical policy issued includes the reflection of the overall technical level in research, development and production through the products. The product structure will be gradually improved in quality, technology level and variety to bring in higher overall benefits under the premise of satisfying market demands. For example, chemical plants, over the years, have mismanaged the ratio of nitrogen, phosphate and potassium fertilizers manufactured, leading to a severe shortage of phosphate and

potassium fertilizers which even destroyed the organic composition of the soil. The technical policy in this area requires immediate readjustment.

#### Selection of Technology -- Searching for the Optimal Overall Benefit

The selection of a technology is to choose the direction of technical development which decides which technology to adopt, which to develop, which to restrict and which to make obsolete. The criterion for selection is the overall economic and social benefits. In selecting the direction of technical development, we must first have a focal point. We should choose to develop a technology which is capable of driving the entire trade forward. For instance, 96 percent of the combustible mineral resources in China is coal.

In the current energy consumption picture, coal only accounts for 69 percent. The utilization rate of coal is only 28 percent. Therefore, it makes a lot of sense to develop technologies associated with conversion and comprehensive utilization of coal as a focal point in the development of energy technology in China.

Next, let us separate the directions and emphases in different phases of a technology development process such as research, development, production and application. Let us also differentiate widely adopted technologies from developing technologies. For example, electrical cable is widely used in the communication business in China. However, optical cable technology is the emphasis in development. This requires some effort to improve the electrical cable technology. In addition, we must dedicate our resources in the research and manufacturing of optical cables to allow us to rapidly make a transition into producing and using optical cables.

Thirdly, in order to develop certain technologies, it is necessary to limit and obsolete some outdated ones. The focus is to obsolete those with poor economic return, high energy consumption and low production efficiency. For instance, steam locomotives must be gradually retired from the railroad business and open wire must be eliminated from the communications industry.

#### Approaches and Methods: Importing Advanced Technology to Strengthen Basic Industries

The way to stimulate technology growth involves a wide variety of issues such as strengthening research and development, commercialization of technical accomplishments, importing, digesting and absorbing appropriate advanced technologies, accelerating the improvement of conventional products by using new technology, implementing an optimization plan which involves comprehensive planning, development and construction, perfecting the quality assurance system, implementing standardization, serialization and generalization principles, using advanced technical means to implement management modernization, implementing specialized and socialized production and collaboration, perfecting and strengthening the basic structure which supports the development of technology and production, improving the quality and standard of the equipment, effective and rational utilization of resources and energy, protecting the ecological environment, accurate selection of vital

technical approaches and flow charts, etc. Here, we will only discuss the two most important issues.

-- In terms of the relation between technology importation and domestic development in China, technology importation should have priority. The technical gap between China and the rest of the world differs in various industries and product lines. However, the overall assessment is that it is 20 - 30 years behind the state of the art in the world. It will be very difficult to catch up by totally depending on our own research from scratch. It will require a considerable length of time. In order to expedite the new strategic transition, we must switch our priority from domestic research to the importation, digestion and absorption of advanced technology. In the next several years to come, the principal technology for Chinese economic growth will be imported. In order to realize this change of strategy, we should organize our best scientists and engineers to study the development trends and relevant technologies in developed nations in order to ascertain which are to be introduced into China. Our leading experts should be allowed to organize and direct the work of importing, digesting, absorbing and duplicating advanced foreign technologies. We should plan to send people abroad to study the project under development. Upon their return, they will participate in the production research phase of the project to form a comprehensive team for research, improvement, digestion and absorption. If this process is effective, we should be able to grasp most of the advanced technologies developed in the past 50 years within a reasonably short period of time to drastically reduce the time required to realize the Four Modernizations.

-- In terms of the relation between developing advanced leading edge technology and developing basic technology and components, the priority should be the latter. Over a long period in the past, China has focused on the development of leading edge technology. We focused on the development of advanced products and on the research in areas of "voids". We neglected to develop basic technology, components and techniques. In reality, it will be very difficult to do well in advanced technology if the foundation is not solid. From a certain sense, to strengthen our foundation has a more general and important significance because any advanced products must be built on a reliable technological base.

For example, the reason why the quality of many products in the Chinese mechanical industry is not very desirable very often is not related to the design of the machinery. It is due to the poor quality of many basic parts. To this end, the Mechanical Technology Policy clearly identifies that the basic components industry must be developed with priority, which includes hydraulic and pneumatic elements, low voltage electrical devices, bearings, gears, chains, fasteners, sealing devices, etc.

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CSO: 4008/2009

## NATIONAL DEVELOPMENTS

### SURVEY ON UTILIZATION OF MIDDLE-AGED SCIENTISTS REPORTED

Beijing RENMIN RIBAO OVERSEAS EDITION in Chinese 13 Sep 86 p 4

[Text] Recently, a survey of over 30,000 middle-aged technical people in more than 500 businesses all over China was conducted. The results showed that 24.3 percent are being fully utilized effectively, 64.5 percent are being essentially utilized and 11.2 percent are not used effectively at all. Based on the statistical data gathered at the end of 1984, there are 4.06 million scientists between the ages of 36 to 55 in China. Based on the fact that 11.2 percent of them are not being effectively utilized, there are 450,000 ineffective scientists in China.

According to our understanding, the major factors affecting their full utilization include:

#### 1. Poor Working Conditions

Approximately one-fourth of the scientists who recently received various awards complained about poor work conditions. The major issues are outdated instruments and equipment, lack of books and information, poor logistic support, an irrational personnel structure and shortage of assistants. Because of the irrational personnel structure, talents are wasted. 12.6 percent of the senior scientists are actually working as junior scientists.

#### 2. Trouble at Home

The strongest complaint of middle-aged scientists concerns their heavy domestic burden, low income and shortage of housing. According to statistics, female scientists who graduated in the 1970's spend 3 to 4 hours on domestic chores, in addition to the time spent in commuting and to assist their children in their homework. They have neither the time nor the energy for learning job related knowledge.

A scientist's home is an extension of his office. According to statistics, 38.3 percent of the middle-aged scientists live in homes under 5 sq m in area.

### 3. Lack of Continuing Education

According to a survey, 77 percent of them have not studied in the past 2 years. Based on the rules, middle level scientists should have 3 to 6 months of studying time away from their assignments every 3 years. In reality, most units have not implemented this policy.

### 4. Alarming Health problems

According to the survey, 49.7 percent of the middle-aged scientists have a chronic illness. This proportion is even higher for people between the ages of 40 to 55. Based on an incomplete statistical survey in Beijing, 60 percent of middle-aged scientists suffer from a chronic condition. The principal illnesses include neurasthenia, heart disease and hypertension.

### 5. Poor Academic Standing

According to a statistical survey, as of the end of 1985, the average age of the committee members in the Chinese Academy of Sciences is 70. 91 percent of them are over 60 years old. There are only 5 members under the age of 50. Approximately 10.1 percent of the middle level scientists are actually performing in the capacity of senior level scientists. However, there are appropriate technical positions for them.

In view of the above results, experts suggest that effective measures be immediately taken to motivate middle-aged scientists in order to utilize their talents to the fullest extent possible.

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## NATIONAL DEVELOPMENTS

### NANSHEN CHEMICAL COMPANY DEVELOPS NEW PRODUCTS

Beijing GUANGMING RIBAJ in Chinese 29 Dec 86 p 1

[Article by reporter Liu Sa [0491 7366]: "Scientific Research And Production Connects With To Create Outstanding High Benefits; In 2 Years of Establishment Nanshen Company Develops 9 New Products; Turns 5 National Key Science and Technology Projects Into Productive Forces"]

[Text] Since May 1984 when the 23 enterprises under the Nantong City Chemical Industry Bureau and the Shenyang Chemical Industry Institute got together and established the Nanshen Chemical Industry Research and Development Company (Nanshen Company for short, subsequently the China Chemical Industry Marketing Company also joined), relying on joining the superiority of both sides, rapidly set up 8 production facilities, developed 9 new products, and increased value of production by nearly 25 million yuan, so that the results of 5 national key science and technology projects were converted into productive forces and the country was saved a considerable amount of foreign exchange.

The Shenyang Chemical Industry Institute is a key institute of the chemical industry nationwide as well as a research and development center for pesticides, dyes and photo-sensitive materials nationwide. For a long time research and development and production at this institute have been seriously out of line. Although some key national science and technology projects have been completed in 4 or 5 years, they have not been able to go into production due to the lack of Chinese test equipment or production base. The Nantong City chemical industry system had a foundation of such refined chemical products as developed pesticides and dyes there were also some idle plant and equipment, but a great shortage of personnel, technology, and new products. After the two sides were joined, they supplemented each other's shortcoming, concentrated on their superiority with obvious results.

The connection effectively promoted the enterprise's technological advance so that the 7 Nantong plants took the bright road out of a deficit predicament. The start of the new products demanded that the workers update their techniques and master the skills to use the new equipment. The Shenyang Chemical Industry Institute sent workers for training as required and improved the technological quality of the enterprise staff.

The connection also strengthened the research and development unit's self-development ability. For the past 2 years, the Shenyang Chemical Industry Institute has received 90 thousand yuan from the company and found effective forms of economic service. The experience of increased product in has also increased the competence of research and development personnel who had learned a great deal of knowledge which is not contained in books.

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## NATIONAL DEVELOPMENTS

### SUPERCONDUCTOR RESEARCH BREAKTHROUGH

ON241347 Beijing XINHUA in English 1310 GMT 24 Feb 87

[Text] Beijing, 24 Feb (XINHUA)--Researchers at the Chinese Academy of Sciences have developed superconductors to liquid nitrogen, achieving a significant breakthrough in this field, said professor Guan Weiyu of the Physics Institute of the Academy.

Speaking at a press conference today, Guan said the new superconductors were modified Ba oxides, composed mainly of barium, yttrium, copper and oxygen.

Experiment results showed that the critical temperature midpoint determined by resistivity was 92.8 K, the critical temperature onset was above 100 K, and the resistance approached zero at the point of 78.5 K.

Guan explained that the superconductors can be applied to the electricity-generating industry by reducing resistance in power lines, which currently wastes up to 60 percent of the power.

In 1911, scientists found that certain metal oxides became resistance-free superconductors under the condition of absolute temperature. But the coolant needed to produce superconductor was very costly and could only be obtained in the laboratory.

In the past 75 years, scientists worldwide have sought superconductors that were above 77 K, at which temperature the coolant could be obtained with cheaper and more easily acquired liquid nitrogen.

The findings achieved by 13 researchers headed by Zhao Zhongxian and Chen Liquan, both associate professors at the Physics Institute, could revolutionize the electronics, instruments, energy and transportation industries.

"However," said Guan, "much basic research work remains to be done and there are still technical problems to be overcome."

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CSO: 4010/1016

## NATIONAL DEVELOPMENTS

### PROGRESS IN TECHNICAL TRANSFORMATION REPORTED

Tianjin JISHU SHICHANG BAO in Chinese 25 Nov 86 p 1

[Text] This year China enters a peak period in the transformation of its technology and in the level of investment in imported technology. The development of technology, technological breakthroughs, dissemination of technology as well as the construction of systems for assimilation and quality assurance are proceeding rapidly. How is Chinese industrial technology progressing this year? This reporter learned recently from the State Economic Commission that this year although the task is difficult, money tight, and there are many problems, technology work is progressing very well. Most tasks will be fulfilled or overfulfilled.

For several years every department and every mining enterprise has stressed improving product quality. Of the 1,424 new and revised Chinese national standards, more than 70 percent conform to international standards or advanced international standards. The proportion of investment in improved technology spent on improving product quality rose from 5.1 percent last year to 6.2 percent this year. Across China 30,000 state enterprises have been recognized for the accuracy of the measurements they make and more than 1,300 large and medium-sized enterprises have began to promote total quality control. Progress is being made in methods for evaluating product quality.

The Provincial Economic Commissions and departments have devoted a great deal of attention to investment in production in this great task of transforming the technology of the enterprises. They achieved significant results. From January through September 1986 the proportion of the planned investments for the year completed was 67.9 percent, an increase of 45.2 percent over the previous year. It is expected that the 1986 plan will be overfulfilled by the end of the year. When inflation in materials, exchange rate fluctuations etc. are considered the amount of work actually done is about the same as last year.

According to incomplete statistics as of the end of September, 1986 enterprises which are tax exempt or pay reduced taxes had already received more than 60 percent of their tax refunds, enabling them to invest this money in transforming their technology and increasing the enterprises' ability to make improvements on its own. The technological transformation of these large

and medium-sized enterprises, the backbones of their industries, is advancing gradually.

Technological transformation and technology imports by some enterprises which earn foreign exchange have received the strong support of the concerned departments of the state. During 1986 the state broadened the autonomy of 281 enterprises which produce machinery and electronic equipment, and implemented technological transformation in 205 of them in order to boost their ability to earn foreign exchange. Three basic changes in technology import work are taking place this year. The emphasis is changing from importing production lines and related key equipment to importing software and necessary related equipment; from enterprises importing on their own to joint importation by research and production units; from principal use in production to assimilation of technology in order to accelerate the development of domestic production. The completion of the importation of 3,000 technological items during the last 3 years of the sixth 5-year plan changed the technological situation of many enterprises.

The State Economic Commission has prepared a number of items to further the assimilation and development of new technologies. Moreover it has prepared a number of debates and agreements relating to the resolution of the SAT items of the the seventh 5-year plan. Among the items on the plan are 116 for technologies which do not exist in China; 60 are to bring China up to the international level of the late 1970's and the early 1980's and 186 which attain the advanced domestic level. According to the statistics of 26 provinces and municipalities and of 8 departments the items which have been fulfilled can increase production 4.0 billion yuan and additional tax revenues of 550 million yuan.

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CSO: 4008/039

## NATIONAL DEVELOPMENTS

### CHEMICAL INDUSTRY CONFERENCE ON WASTE WATER TREATMENT

Beijing ZHONGGUO HUANJING BAO in Chinese 11 Nov 86 p 1

[Article by correspondents Zhou Xianhui [0719 3759 1979] and Zhao Xing [6392 5281]: "Take Full Advantage of Existing Water Treatment Facilities; Chemical Industry Holds Conference on Water Treatment Situation; Vice Minister Lin Yincai Stresses that Operating Efficiency of Entire Water Treatment System Will Reach 100 Percent in 1988; Clearing the Way for the Chemical Industry's Eighth 5-Year Plan"]

[Text] Editor's note: Making waste water treatment facilities operate properly is an important problem in environmental protection work. In recent years the state has invested one billion yuan water treatment. However, a portion of this large investment has not been used effectively. Problems of lack of information, proper management, technology or incorrect policies have prevented some water treatment facilities from operating properly. Some facilities have even been abandoned altogether. Incessantly building new water treatment facilities while neglecting to utilize those that have been built is a great waste of resources and will make environmental pollution even more serious.

The leadership committee on environmental protection of the Ministry of the Chemical Industry is concentrating on the facts, on efficiency and is determined to solve problems concerning the operation of water waste-treatment facilities. Their methods are worth considering as an example of what can be done. We hope that other areas and other ministries will, like the Ministry of the Chemical Industry be able to study carefully the actual situation, discover the factors which affect the proper operation of water treatment facilities and determine methods to resolve problems. The Ministry of the Chemical Industry also established concrete goals and requirements, and strengthened inspections.

Lin Yincai [2651 3009 2088], chairman of the environmental protection leadership committee of the Ministry of the Chemical Industry and vice-chairman of the standing committee and eight department and agency heads who are members of the environmental protection steering committee met from 22 to 24 October in the offices of the Ministry of the Chemical Industry plant No 1 at Baoding. The group, intent on discovering the facts of the matter and on boosting efficiency, studied how to improve waste water treatment facilities and developed a policy on the future construction of waste water treatment plants.

The Chinese chemical produces 6.8 billion tons, or one-fifth, of all the waste water produced in China annually. Currently 70 percent of these waste water systems discharge waste water without treatment. In recent years 170 million yuan has been invested in waste water treatment in industrial chemical systems. However, a survey of more than 100 water treatment systems which have been completed shows that the operating rate of these facilities is only 73.5 percent and that just 47 percent of the effluent meets waste water standards. The proper management of water waste treatment facilities which have been built has become an important problem in environmental protection work on industrial chemical systems. If this problem is not properly resolved then the growth of the chemical industry will be inhibited. Therefore the environmental protection leadership committee of the Chemical Industry Ministry called a national conference of the leading workers in environmental management and scientific and technical workers to establish comprehensive standards for waste water treatment at the Ministry of the Chemical Industry film plant No 1. This plant has the distinction of not having to pay a penalty for water pollution. The group studied the advanced management experience of this plant, examined the causes of improper use of water treatment facilities and looked for solutions.

The leadership committee of the Ministry of the Chemical Industry believes that several measures can help solve current water treatment problems. These measures are better control of the production process; preprocessing to prevent the discharge of high density wastes between cars; ensuring the quality of the water which enters the water treatment system; water quality requirements; separating clean and waste water flows; the establishment of a complete system for managing and inspecting water treatment facilities; and improving water treatment facilities. These are the keys to the proper and highly efficient operation of water treatment facilities. The goals which the leadership committee has set for the entire industry are bring the operation ratio of water treatment systems to more than 90 percent in 1987 and to 100 percent in 1988; boost the proportion of waste water which meets waste water processing standards to 60 percent in 1987, to 70 percent in 1988, and to 80 to 90 percent in 1989. Henceforth annual meetings will be held to exchange experiences in waste water treatment, to measure progress against the above standards, to assess and discuss waste water treatment and to gain a solid grasp of the topic needed to put it into practice.

The steering committee also decided that future construction of water treatment facilities for the chemical industry should conform to waste water treatment principles, employ advanced manufacturing technology and rationalized materials, improve the overall resources utilization ratio and reduce the quantity of pollutants released into the environment to the smallest amount possible. Moreover waste water treatment facilities should be suited to the characteristics of the industry; needless copying or indiscriminate use of waste treatment systems used elsewhere should be avoided. The treatment of waste water produced by the chemical industry should evolve towards the treatment of all chemical wastes produced in a region.

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CSO: 4008/2039

## NATIONAL DEVELOPMENTS

### SHANGHAI COMPUTER INDUSTRY PROGRESS REPORTED

Shanghai JIEFANG RIBAO in Chinese 3 Jan 87 p 1

[Article by reporter Zhang Zhongfang [1728 0022 2455]: "Three Years of Hard Work to Gain a Foothold; Articles Written On Applications; Shanghai Computer Industry Comes Out of 'Slump'; Last Year Value of Output Rose Over Previous Year by 60 Percent; Profits Exceeded Plan by Nearly 30 Percent"]

[Text] At the beginning of the new year reporters met with Wang Haoyang [3769 3185 7401] and Zhao Xingyao [6392 5281 5069], the managers of the Changjiang Computer Joint Company and asked them what the computer industry production was like in Shanghai last year. With one voice they said that they were surging out of the "slump," beginning to rise, and that a better situation than that of the last 4 years has appeared. Then they presented a string of numbers as evidence: the annual industrial gross output value increased 60 percent over last year; total profits exceeded the plan by 29 percent...

People familiar with the inside situation know that in the past few years, China's computer industry development has been very unbalanced. Enterprises with foreign exchange available have developed an attachment with foreign packages and components and "struck it rich"; but those without foreign exchange have felt it really hard, "both bitter and poor." And how has the Shanghai computer industry come out of the "slump"? The reporters asked Wang and Zhao directly to explain: "'How much water' does this 'startling' series of numbers of the yours hold?"

"Ha-ha, these numbers of ours are solid 'dry goods,' no lie! Zhao Xingyao, who is also head of the Shanghai Computer Plant said, "We fought hard for 13 whole years, borrowed foreign advanced technology, and developed 16 domestic products, including two microcomputers carrying the 'Donghai' name which have already become the mainstay of the industry. This is the cornerstone of our coming out of the 'slump'." Zhao Xingyao gave the reporters some materials which contained the following:

"The 'Donghai' 0520C microcomputer is domestically manufactured, has operated flawlessly for over 1,500 hours, and has been awarded the Shanghai Municipality Superior New Product First Class Prize. In 1986 it went into batch production, over 1,000 units were provided for use by banking system, municipal economic

commissions and educational system and related units, which is something rare for Chinese manufactured computers. In addition, the STD industrial control single-board microcomputer system series developed jointly the Shanghai Computer Technology Institute and the Shanghai Microcomputer Plant, while ensuring quality, Chinese-made components were used for medium and small scale circuits, resistance and capacitance, and after the country was short of foreign exchange, this was an important reason why it was possible to go into large volume production."

Manager Wang Haoyang said that another important reason for the revival of the Shanghai computer industry is that new computer applications areas have opened. The Shanghai computer industry system wrote three large articles closely focused on the 12 major computer applications projects controlled by the state: one was the banking processing system; second was the railroad car automation organization; and third was the automatic telegraph relay system. These supply and demand relationships in which "production is determined by use" made the Shanghai computer industry's annual production take the road of health and stability, and economic benefits. It is estimated that there will be a great increase in the number of applications projects started this year over the past year.

Deputy Manager Zhao Xingyao added that developing technological service is a third important reason why computer production and marketing thrived last year. Last year technical training and maintenance centers were opened, held nearly 4,000 training sessions and accepted or provided on site maintenance of over 2,000 computers.

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CSO: 4008/1038

## NATIONAL DEVELOPMENTS

### SHANGHAI'S METALLURGY INSTITUTE'S 16-BIT MICROCOMPUTER CPU PASSES APPRAISAL

Beijing DIANZI XUEBAO [ACTA ELECTRONICA SINICA] in Chinese Vol 14, No 6, Nov 86 p 78

[Text] The 16-bit microcomputer CPU smZ8000/ was successfully developed by the Shanghai Metallurgy Institute of the Chinese Academy of Sciences and passed Chinese Academy of Sciences-level appraisal on 13 August 1986. The functions of this CPU circuit are powerful: It can execute 414 commands, has a direct address range of 8 megabytes, and has an operating frequency of 4MHz. The chip's area is 6 x 6.5 mm<sup>2</sup>, and integrates 17,500 MOS transistors. Computer assisted designed, masking, and E/D NMOS technology were used, including such advanced technology as metallic ion injection doping and reaction ion etching. The circuit's performance reaches the norms for similar Z800 products abroad and they are interchangeable. The appraisal committee specialists unanimously felt that the research and development of the smZ800 which is the first 16-bit microcomputer CPU developed by China was a engineering project involving a concentration of technology, high level of difficulty, and great deal of work. The successful development of this circuit shows that China's research on microelectronics technology has achieved a new level and provided key components for realizing domestic production of microcomputers.

The Lishan Microelectronics Company of the Aeronautics Ministry participated in this research and development work and has begun batch production.

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## NATIONAL DEVELOPMENTS

### OPTICS DESIGN SOFTWARE PACKAGE FOR MICROCOMPUTERS

Beijing GUANGMING RIBAO in Chinese 29 Dec 86 p 2

[Article by reporter Wang Zhe [3076 0772]: "Microcomputer Optics Design Software Package Introduced; Achieves Advanced International Levels For Similar Software Packages"]

[Text] A microcomputer optics design software package jointly developed by the Beijing Industrial Academy, Huabei Optical Instrument Plant, Xian Applied Optics Institute, Huadong Industrial College, Changcheng Optical Instrument Plant, and Huadong Optical Instrument Plant recently Weapons Industry Ministry appraisal at Beijing. The famous optics specialist Wang Dayan [3769 1129 5888] participated in the appraisal.

This 19 function software program package, which includes coaxial and noncoaxial systems, is used for optical design of spherical, quadratic, (gaoci [7559 2945]) curves, cylindrical, (zhuomian), grating and (feinie'er [6316 3206 1422]) lens surfaces. Most of the programs in the software package have been gradually developed and improved after a long period of practice with the original program; the newly developed programs also have been through a period of trial use which establishes that they are effective and reliable. The programs in this software package all have reached the practical level.

The appraisal recognized that the contents of this software package are rich, full-functioned, varied in method, reliable in their calculations, easy to use, and that the contents of some are creative, and that it has achieved the advanced levels of similar software internationally in the eighties.

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## NATIONAL DEVELOPMENTS

### PATENT BUREAU DIRECTOR'S WORK REPORT

Beijing ZHONGGUO ZHUANLI [PATENT REVIEW OF CHINA] in Chinese No 12, Dec 86  
pp 13-22

[Speech by Huang Kunyi [7806 0981 413], director of the China Patent Bureau at the Second National Conference on Patent Work: "Uphold the Reform, Conscientiously Implement the Patent Law"; date of speech not given]

[Text] Comrades:

Today marks the beginning of the Second National Conference on Patent Work. The purpose of this conference is to review and exchange our experiences in the implementation of the patent law, to study the way to carry out Premier Zhao Ziyang's important directive on "applying the patent law earnestly," to clarify the goal and orientation of patent work during the seventh 5-year plan, and particularly to study the question of developing patent work among enterprises. In addition to the responsible comrades of various localities and departments and the organizations in charge of this work, 50 others representing enterprises and patent service organizations are also present.

This conference is convened at a favorable moment when the national economy is undergoing normal, coordinated, and healthy development and all people are studying and implementing the "Resolution of the CPC Central Committee on the Guiding Principles for Building a Socialist Society with an Advanced Culture and Ideology." Upholding the two civilizations and promoting the reform and the policy of opening to the outside constitute the guiding thought in all types of work and in making this conference a success.

Today, I would like to present several views.

#### I. Application of Patent Law

The present situation of patent work is generally good.

Implementation of the patent law began on 1 April last year, and on the very first day, a total of 3,455 applications were received. Bao Gexu [7637 2706 5171], general secretary of the UN World Intellectual Property Organization, commented: "This has set an absolute record in the patent history of the world." On 10 September last year, 150 patent applications were announced in

a public notice, and on 28 December, an impressive ceremony was held in the Great Hall of the People to award the first batch of certificates for 143 patents in China. The approved patent rights were announced in the same year of application.

After the rush of the first day, the number of applications submitted soon became steady, averaging some 40 per day. This number has remained steady, or has slightly increased, averaging nearly 50 per day, since the beginning of this year. Through 31 December this year, the Patent Bureau received a total of 28,963 applications, including 15,134 applications, 52.3 percent of the total, for invention patents; 12,573 applications, 43.4 of the total, for utility model patents; and 1,256 applications, 4.3 percent of the total, for design patents. The number of domestic applications was 20,007, 69.1 percent; and that from abroad was 8,956, 30.9 percent of the total number.

This shows that China's patent law has effectively aroused the enthusiasm to invent and create, while developing the intellectual resources at home and attracting advanced technologies from abroad. Now, applications are being submitted in all provinces, including Taiwan Province, autonomous regions, and municipalities directly under the central government throughout the country, and the top 10 of them in terms of the number of applications are Beijing, Shanghai, Liaoning, Jiangsu, Hunan, Shandong, Sichuan, Zhejiang, Tianjin, and Hubei. Many scientific research organs, universities, and specialized colleges have also submitted large numbers of patent applications. Up to now, 47 foreign countries and regions have come to China to apply for patent rights, and the first 5 of them are Japan, the United States, FRG, Great Britain, and Holland.

Now, the legal procedures including the preliminary examination, substantive examination, announcement, opposition, authorization, reexamination, and invalidation are being followed. Through 31 December this year, 8,613 applications for various patents were received, including 4,589 for invention patents, 3,364 for utility models, and 560 for designs. The number of approved patent applications was 79 for inventions, 1,951 for utility models, and 396 for designs. We also received 32 requests for reexamination, and invalidated 2 applications. The work of the Patent Bureau is now proceeding in earnest in various aspects, and our operation, hitherto on a trial basis, has become regular.

The patent system has begun to exercise its two functions, namely, information exchange and compensated technology transfer under the protection of law. Some of the items, for which patent rights have already been granted, and some others, whose applications are under examination, are already exploited and have produced results in socialist economic construction.

The exploitation of some items have prompted the technical transformation of some traditional industries, the development of some new products and new techniques with Chinese characteristics, the improvement of product quality, and an increase in foreign exchange earning capacity. For example, the "nonprecious metal beehive-shaped combustion catalyst," in which porcelain clay, rare earths, copper, and manganese are used instead of precious metals, has the advantages of low cost, good properties, long service life, and

extensive utility. Soon after its appearance, the demand on the national market exceeded its supply, and contracts for the export of 200,000 units at the value of \$200,000 have already been signed with the United States. The prospect of foreign exchange earnings is very promising. Another example is the "nonlinear magnetic vibration hydraulic compressor," a nonservice invention by Cao Peisheng [2580 1014 3932] of Shanghai. It was successfully manufactured on the basis of the technology of nonlinear vibration control and a series of new nonlinear theories. It helps conserve energy and materials and reduce noise and is being exploited in Shanghai and Xiamen with good results. This technology may find its way into the United States where it will be used as technological investment in a joint venture. Still another example is the "impact crushing and discharging funnel," designed on the basis of the theories of elasticity, plasticity, and laminar shell mechanics. It is simple in structure, reliable in operation, convenient for installation and dismantling, and low in cost. In terms of theory and design, this invention is superior to those of the United States, the Soviet Union, and England based on similar patented technologies of the 1980's. It has already begun to displace some of its U.S. counterparts of the 1980's imported several years ago.

The exploitation of some items has opened a new way for the development of energy resources and the reduction of energy consumption besides the effective reduction of environmental pollution. For example, the technology used by the photo-sensitive chemistry institute of Chinese Academy of Sciences for the manufacture of "high-density coal slurry" with humus salt from plant ash, weathered coal, lignite, or sulfo-salt derivatives as additives, can raise the coal content of the paste to 70 percent. This was an important breakthrough in the technology of coal slurry production in China. Again, the technology for "oil burners in industrial furnaces" and three other technologies adopted by nonservice inventor Yan Mengqiu [7346 1322 4428] of Changsha County of Hunan have been used in hundreds of industrial oil furnaces. The oil conservation rate reached about 1.5 percent, and the unburned fuel left in the waste gas discharged may be lowered to 14 PPM. The economic and social benefits derived are remarkable because of the small investment required and the quick investment returns. Another example is the "diesel engine exhaust muffler" manufactured by Tianjin Tractor Plant. Based on a different theory, the structure of this technology is fundamentally different from those of other diesel engine mufflers in China. It the effects of noise reduction and energy saving. More than 20 factories are now producing this type of muffler which will gradually replace the mufflers of various models of Chinese-made or imported vehicles.

The exploitation of some items has promoted the integration of scientific research with production and the specialized and socialized cooperation among enterprises. For example, the "method of magnetic reselection of aggregates and the selection separator to be used" was the result of close cooperation, demonstration of each party's strength, and a common effort in development among the research institute for the comprehensive mine utilization under the Ministry of Geology and Mineral Resources, its Zhengzhou branch, and the Capital Iron and Steel Corporation. It was their combined efforts that led to its smooth exploitation. After adopting this technology, two ore selection plants of Capital Iron and Steel Corporation increased their annual

output of refined mineral powder by 700,000 tons, and their economic gains by 22.88 million yuan, without expanding their factory buildings or increasing their personnel. An increase in the productive capacity by 700,000 tons with the former technology would require an investment of 60 million yuan. With the new technology, however, the investment was only 10.53 million yuan which would be fully recovered in half a year. Under the system of contracting, Capital Iron and Steel Corporation has gained tremendous leverage for improving economic results and great power to adopt new technologies. Thus in less than half a year, the technical transformation for all its 22 ore separation plants was completed with great results. From this, we can see that the implementation of the patent law has a close bearing on the reform including the increase in the decisionmaking power of enterprises. Another example is the "high-grade fully-automatic roller laundry machine" of Shanghai's nonservice inventor Yang Xiaoyu [2799 2400 4416]. Its structural property is superior to that of its foreign counterparts, and 82 enterprises with their branches in 8 different provinces and cities have organized their integration according to the requirements of this product for marketing. Thanks to their joint efforts in exploitation and production, this product will be completely Chinese-made with greatly reduced production costs. It will soon find its way into the international market, since some foreign traders have already requested to serve as sales agents for this product.

Patent work has also yielded gratifying results in national defense science and technology, which not only concern the security of the state, but also have the attributes of commodities. They may enter a special market for technology with limited circulation. At present, 29 national defense patents have been approved. Practice has proved that application of the national defense patent system can help arouse the enthusiasm of the personnel engaged in national defense science and technology, remove the obstacles to the free flow of information within the military industry system, and popularize the internal application of scientific and technical achievements in national defense. The application in national defense has also shown good results.

To report on the exploitation of patented technologies, the Patent Bureau held a small "exhibition of patented technologies" during the conference session. All the exhibits were from technologies for which the grant of patent rights was pending (and for some of them, patient rights had already been granted and announced), and many patented technologies were used in the construction of the exhibition hall's structural frame, and the production of construction materials, decorative paints, and electrical appliances used in the hall. Because of limited facilities, these exhibits represented only a small portion of the technologies for which applications for patent rights have been filed. These exhibits, therefore, are not necessarily representative in nature. We hoped that they could show us at least one aspect of the initial role played by the implementation of the patent law on technological progress.

In less than 2 years after the implementation of the patent law, the patented technologies have already shown economic and social benefits beyond our expectation. However, this is only the beginning, and a promising future is still ahead. The patent system provides legal protection for all inventions and creations, and fully publicized the information on them. Along with the popularization of this system, the intellectual resources in China will be

further developed, and the trade in patent licenses will become an important form of compensated technological transfers. Patented technologies will play a more extensive role in economic construction.

The present situation of patent work is heartening. However, it has not come easy. First, it is attributed to the reform and the policy of opening the country to the outside world and invigorating the economy at home. Without due respect for knowledge and talented people; without recognizing the theoretical breakthrough made by technology as a commodity; without the opening of a technology market and the practice of compensated technological transfers; without greater decisionmaking power for enterprises; and without the simplification of administration and decentralization of power so that state affairs can be decided under a democratic legal system, it would be impossible for the patent system to be enforced in China, or, even though enforced, to acquire such strong vitality.

At the same time, this new phenomenon is the result of persistent efforts on the part of the comrades in various work posts of the patent system in upholding the reform and undertaking their arduous pioneering task. The patent system has now been initially formed throughout the country, because, in addition to its Shanghai branch, the Patent Bureau has also established five agencies in other parts of the country. The National Defense Scientific and Technological Industry Commission has set up a preparatory group for a national defense patent branch. A total of 94 patent administration bureaus (departments) have been established in various localities and departments, forming a nationwide patent administration system. Three patent agencies dealing with foreign countries--namely the patent agency department of the China Council for the Promotion of International Trade, the China Patent Agency Company, and the Shanghai Patent Office--and 245 domestic agencies have been opened with nearly 7,000 trained agents in the patent agency system. There are also 62 network outlets for the announcement of China's patent documents. These outlets, the document service centers, and the branch centers at various levels of the China Patent Bureau, have combined to form a document service system of China. The Chinese people's courts have also completed their preparatory work for the trial of patent cases. Furthermore, local research associations for industrial property have been formed throughout the country to promote academic activities regarding patent work. The smooth implementation of the patent law is inseparable from the pioneering spirit and great efforts of the comrades concerned.

After the announcement of the patent law, a set of rules and regulations were worked out for its implementation so that even in the initial stage, there could be fairly specific rules to go by. This is an important guarantee for the smooth implementation of the patent law.

In addition, after the implementation of the patent law, we did a great deal of propaganda and personnel training. Our propaganda was a great success, thanks to the support from the newspapers and the publishing circles. Broadcasting, television, newspapers, magazines and other mass media devoted a great deal of time and space to the work of publicizing China's patent law and its progress to people at home and abroad. The Patent Law and the Regulations on Implementing the Patent Law have been translated into English, French,

Japanese, German, Spanish, and many other foreign languages and published in both China and foreign countries. The Patent Bureau, the patent administration organizations of various localities and departments, and the China Industrial Property Research Association have held hundreds of study classes, publicity meetings, report meetings, symposia, and discussion meetings. Many provinces and cities have regarded the study of patent law as an important feature of the work of popularizing legal knowledge in the past several years. The China Branch of International Society for the Protection of Industrial Property Rights held a "China's Patent Law Discussion Meeting" in Beijing attended by more than 300 persons of the international industrial property right circles. The Patent Bureau and its agencies for foreign affairs also held many report meetings on China's patent law in Europe, the United States, Japan, and Hong Kong. People at home and abroad are beginning to understand China's patent law. Director (Bulandeli) of European Patent Office said: "China's patent law is like a baby, barely a week old. This baby is very healthy and her voice can be heard all over the world, to people's surprise."

In more than 2 years, thanks to people's common effort, more than 10,000 patent workers have been trained in different ways. This was another important factor in the successful implementation of China's patent law. Foreigners have thought that China would encounter obstacles from the lack of qualified personnel in the implementation of its patent law. However, practice has proved that the quality of our work force can by no means be unsatisfactory. The director of European Patent Office has once solicited comments from people in the same line of business in Europe, and concluded that China's Patent Bureau's judgement as announced after the first substantive examination was of a high quality. Just because of our attention to the work of publicity and training, the high quality of our application examinations was assured at the very beginning, and even before our first step in the implementation of the patent law was taken.

Active development of international exchange and cooperation has also helped in the smooth implementation of the patent law. China has joined the World Intellectual Property Organization and the Paris Convention for the Protection of Industrial Property. Last year, in a conference of the leading organs of the World Intellectual Property Organization, China was elected member of the executive committee of the Paris Union. I, as the Chinese delegation leader, was elected chairman of the Paris Union Conference. By now, China has established good cooperative relations with the patent offices of more than 10 countries--including the FRG, Japan, France, Austria and the United States--and the European Patent Office. In our cooperation with FRG, we have made great achievements in the use of computers for handling business matters, the management and publication of documents relating to patent rights, and the monitoring on personnel training. Our cooperation with Japan and the United States in setting up a patent document data base has also begun.

The implementation of our patent law has made a good start. However, this is only the success of a trial operation. We should not over-estimate our present achievement, and much less overlook the problems involved. Since our publicity work on the patent law has not been sufficiently extensive or intensive, many people still fail to recognize its importance, and so far, not

many applications for service inventions-creations, especially from the enterprises, have been filed. The patent system is still far from perfect, because of the shortage of personnel and funds. The patent regulations need further improvement, since the problem of coordination between the regulations of the patent department and those of the other related departments still needs to be solved. Without modern means of information handling, patent information cannot circulate freely. There are also many obstacles to the exploitation of patented technologies, and the quality of application examination needs improvement. The business mentality of the patent work force, and particularly the patent office personnel, is not equal to their task, and some comrades do not have a clear idea of their service. That is why in front of our achievements, we should also be soberly aware of the problems and the very arduous task confronting us.

## II. The Goal and Task of Patent Work During the Seventh 5-Year Plan

Our experiences in more than a year has proved the irreversible trend of the implementation of China's patent system. However, the implementation period has been very brief, and some more time should be spent in reviewing our experiences. In this sense, the seventh 5-year plan should be an important occasion for our patent system to be put to test, and the period of transition from trial to regular operation, and from the initial to the mature stage. During the seventh 5-year plan, our patent work should provide not only advanced and suitable technologies for doubling the industrial and agricultural output value in the national economy, but also a technological reserve for the economic take-off during the eighth and ninth 5-year plans. Therefore, the seventh 5-year plan will be the time for the patent system to begin its all-around service to the four modernizations. That is why in our opinion, the general demand on patent work during the seventh 5-year plan is to uphold the reform, to enforce the law conscientiously, to promote both civilizations simultaneously, and to consolidate and develop the patent system in order to serve the purpose of invigorating the economy and achieving the four modernizations.

The volume of patent applications has a direct effect on patent work in various aspects. We have made an estimate of the volume of these applications during the seventh 5-year plan. In 1985, the number of applications was 14,000. Based on the volume in the first 10 months, the total volume of this year may reach 17,000. In 1985, although we began accepting applications on 1 April, 3,400 of them were received on the first day. These applications were basically prepared in advance and held until the date of their submission on 1 April. Actually, the volume of 1985 should represent the volume of the whole year. Thus the volume this year will be about 3,000 more than last year. Based on this increase, the volume in 1990 will reach 30,000 and the total volume during the seventh 5-year plan will be 100,000-120,000. According to this estimate, the Patent Bureau should make every effort to examine and approve the applications in time for announcement in 1990, by which time, 80,000 to 100,000 applications will be announced, and 30,000 to 40,000 of them will be approved. Generally, our work will be planned according to this estimate.

To attain the objectives of the seventh 5-year plan, we must, first of all, carefully attend to the following tasks:

#### A. Setting Up a Good Patent Work System

While the formulation of the patent law was in progress, we proceeded with the task of establishing a national patent system. The initial establishment of this system has played an important role in the implementation of the patent law, and its improvement will be an important organizational guarantee of further success during the seventh 5-year plan.

In order to set up an efficient patent system, we are of the opinion that the following problems of understanding should be first solved:

1. The problem of understanding the important strategic position which scientific and technical progress and intellectual development should occupy. The "Resolution of the CPC Central Committee on the Guiding Principles for Building a Socialist Society with an Advanced Culture and Ideology" pointed out: "In our modernization drive, it is especially important for us to pursue knowledge and to respect and utilize science. We should work hard to universalize education and to spread general and scientific knowledge throughout the country and to raise the people's cultural level." Premier Zhao Ziyang said in his "Report on the Seventh 5-Year Plan": "A striking feature of the seventh 5-year plan is the importance it places on developing science and technology so as to provide a more solid base on which to build our economy." "Whether or not we can find effective solutions to many of the major problems of our economic development depends on whether or not we can make major breakthroughs in science and technology. Likewise, the advance of science and technology is the profound source of the vitality of China's future economic development. It should be noted in particular that with the rapid development of the new worldwide technological revolution, more and more countries are shifting their attention to the development of science and technology. Under these circumstances, unless we adopt proper policies to meet this challenge now, the gap between us and the developed countries will widen rather than narrow, and it will become more and more difficult for us to catch up with them economically and technologically." "At present, it is essential to ensure that the whole nation understands the strategic importance of science and technology and has a sense of urgency about speeding up their development." Premier Zhao further pointed out: "We must conscientiously apply the patent law to protect the rights of inventors and stimulate the creativity of scientists, engineers, and workers." We must conscientiously study and carry out these instructions, enhance the eagerness to apply the patent law, and ascertain the goal and orientation of the patent system.

2. The problem of understanding the need to protect patent rights. Protection of patent rights is the core of the patent law as well as the core of patent work. Under socialist conditions in China, the problem of understanding why the patent system has to be established can be fundamentally solved only provided the need to protect patent rights is understood. The Soviet Union adopted a double-track system whereby the inventors in the country were given certificates for their work in the country and granted patent rights for their inventions for foreign countries. Actually, patent rights were not recognized

in the country, and only a reward system was in force. That was why the patent system could not play any significant role in the Soviet Union. In China, if the patent rights are not protected, we will not be able to bring into play the "two functions" and obtain the "three advantages" (namely, the advantage of encouraging inventions-creations, the advantage of popularizing their application, and the advantage of importing advanced foreign technologies) and China's patent system will not work efficiently. Inventors and applicants for patent rights at home and abroad had their misgivings about the newly established patent system in China. After all, they had to watch and see whether the patent rights could be protected in practice. A large U.S. corporation openly stated that it intended to file 200 patent applications with China and see if the patent rights could be actually protected before deciding on filing applications in larger numbers. Some Japanese and European applicants have shown similar attitudes. Therefore, real protection for patent rights is an important factor in the sustained development of China's patent system, as well as an important means of determining the patent system's degree of perfection.

3. The problem of understanding the patent system itself. Patent work involved many spheres including the judiciary, the administration, the establishments and the enterprises. Therefore, we cannot regard the patent system as a purely administrative system. In patent work, the implementation of patent law should be a common task with distinctive legal standards and legal procedures. This is a very significant change from the work style of mainly administrative control to which we are accustomed. All our comrades engaged in patent work should be aware of this change and must think and act accordingly; otherwise we would be like wearing a pair of new shoes only to walk on an old road which may lead the new system astray.

The patent system is only one of the subsystems of the state's scientific and technical, economic, judicial, cultural, and educational systems. Therefore, it should not be treated as an isolated system, and must be combined with the other systems so that they can infiltrate into one another. The patent law must be coordinated with the rules and regulations of the adjacent areas, and the lateral ties among them should be strengthened. Effort must also be made to include patent work in the agenda of the department for the comprehensive administration of science and technology, and the economy, so that it will truly become the state's powerful tool for scientific and technological advancement.

Second, we must attach great importance to the practice of China's patent work.

China's patent system was transplanted from foreign countries, and it is necessary for us to draw some useful experiences from foreign sources. However, there can be no complete set of experiences that are compatible for China's national conditions for our ready reference, and it is necessary for us to review our own practical experiences carefully. That is why the exchange of experiences in implementing the patent law over the past year or more is listed as an important item in this meeting's agenda. It is gratifying that many localities and departments have gained valuable preliminary experiences in patent work. Their representatives have exchanged

experiences here in speeches or in written forms. Many of them have introduced some new elements of the work or have made important achievements in certain respects. I hope all comrades attending this meeting will actively participate in the exchange of experiences, review of these experiences, raise the standards of their work, and thus become important spiritual assets for the patent system. Based on the experiences summed up by everyone, the patent work which has been carried out satisfactorily in different units has the following common features:

1. Solution of the leadership problem as a strong impetus to the reform. The leadership of the people's higher courts has attached great importance to its preparatory judicial work for the implementation of the patent law. Before the implementation, it also worked out the rules and regulations concerning the trial of patent cases, and trained its personnel for handling litigation in economic courts. The reaction in this country was favorable, because "if the channels to litigation are open, patent rights will be truly protected." The China Council for the Promotion of International Trade treated the work of patent agencies dealing with foreign countries as a new feature of their activities. The standing committee of Jiangsu Provincial People's Congress and the provincial government have published monographic discussions on the situation of patent law implementation and included patent law in the outline of legal knowledge popularization. They also economically supported the development of patent work with the allocation of patent funds, approved the promulgation of "Regulations for the Administration of Jiangsu Provincial Patent Agencies," "Provisional Regulations for the Collection of Fees by Jiangsu Provincial Patent Agencies," "Regulations Concerning the Management of Expenditures on Patent Rights and Patented Technologies," "Provisional Regulations for Handling Patent Disputes of Jiangsu Province," "Regulations of Management of Licenses and Contracts for Patent Exploitation of Jiangsu Province," and other local patent statutes, besides setting up patent work procedures. Beijing Municipality has decided to include patent work in the system of scientific and technological administration, and called on all units under the municipality to do five jobs, namely, to publicize the patent law, to apply for patent rights, to exploit the patented technologies, to import patented technologies, and to verify the originality before developing any technology. In Sichuan, the Science and Technology Commission, the Planning and Economic Commission, the Foreign Economic Relations and Trade Department, and the Foreign Affairs Office jointly issued a notice for strengthening patent administration in technology imports. In Hunan, the leadership personally attended to the exploitation of patented technologies and appropriated special funds to support their development. The Ministry of Metallurgy, the Ministry of Machine Building, the Chinese Academy of Sciences, and the State Education Bureau conducted the universal training of patent personnel for their affiliated units, thus giving a strong impact on the patent work in these sectors. In some other provinces, cities, and departments, the leadership has attached great importance to patent work and adopted many practical measures to promote its development. After all, in these provinces, cities and departments, their fairly good performance in patent work is inseparable from the close attention of their leadership. In some cases, the leadership understands patent work is able to hold the initiative; in other cases, the patent administration organs working actively under the science and technology commission have won the leadership's support.

2. Effects of a fairly good work foundation. They have taken care to orient their patent work to their scientific and technical personnel, their affiliated scientific research and teaching units, and their industrial and mining enterprises; to continue the propagation of the patent law with untiring efforts; to popularize the knowledge of patent; to train patent personnel; to improve the quality of applications; and to exploit the patented technologies so that new prospects of the work could be gradually opened to yield early economic and social benefits. Beijing Municipality adopted different methods to open technology markets in different forms, helped the rural enterprises import new technologies, and promoted the exploitation of patented technologies. A sample survey of 150 items, whose patent applications had already been announced, showed that 50 percent of them had already been exploited with a direct economic gain of 14.28 million yuan. Hunan Province has transferred its patented technologies to other provinces besides exploiting them locally. A number of transfer contracts have been signed. In Shanghai, Liaoning, Shandong, Wuhan, and Dalian, many patented technologies have been exploited with good results.

3. Formation of a basic patent contingent and its self-improvement. In the course of its growth, great attention was paid to the building of a smaller but better organizational structure with more competent personnel, and to the establishment of a patent administration system and a service system inside each region and department. In these regions and departments, a number of patent business offices, patented technology development centers, and document service centers are already functioning efficiently. They also carefully attended to both civilizations simultaneously, efficiently handled the relationship between thoroughness in law enforcement and enthusiasm in offering services, formed an excellent work style, shared the thoughts as well as the anxiety of inventors, and thus won the admiration of the inventors and applicants. In appreciation of the efficiency of the patent administration department and the patent business office in Yantai, some inventor sent them two silk banners with these inscriptions: "The home of inventors," and "The bosom friend of science and technology." This is very high praise for the comrades engaged in patent work. There is also a historical anecdote about Yantai. Fenglai County under Yantai was formerly called Dengzhou, where Su Dongbo served as a magistrate for 5 days. His administration advanced welfare of the people and revitalized the salt industry. For his good deeds, the local people built the "Master Su's Temple" in his memory. That is why even to date, the ditty "Although he was the magistrate of Dengzhou for only 5 days, Master Su's temple will remain for thousands of years" is still current. This shows that as long as some one did something good for the people even in a feudal society, the people would never forget him. Today, under socialist conditions in China, we should do even more good deeds for the people. China's patent system exists under socialist conditions, and all legal and economic means are intended to serve the people. Therefore, there must be a unity of strict enforcement of law and warm service for the people. We must warmly serve the inventors, designers, and patent applicants, and do more practical and good deeds for the people.

Third, we must streamline the relationships and strengthen the work of patent administration.

To improve our work in patent administration, we have drafted the "Decision on Strengthening the Patent Administration Organs (Discussion Draft)" according to the stipulations of the patent law and State Patent Bureau Document No 130 of (84), and hope that after full discussion in this meeting, it will be revised and formalized as a document. At present, the patent administration organs including some business offices and document centers have real problems in their work, and the solution of some of these problems would take a fairly long time. Therefore, aside from a standard set of documents, we also need to work out construction plans for the patent system.

The China Patent Bureau will formulate plans of its own in the effort to transform itself into a modern patent office with good work style, high efficiency, and the quality of examination approaching that of advanced countries in the world. Then in collaboration with the localities and departments, it will establish a patent system with Chinese characteristics. Based on the estimate that the number of applications will double in 1990, it will immediately work out its second-stage engineering plans, and the plans for personnel disposition and training and structural reform, all to be submitted to the relevant departments of the state for examination and approval. Recently, the Patent Bureau has received approval from the State Industry and Commerce Administration for establishing the China Patented Technology Development Company to promote the exploitation of patented technology. It will also consider the decentralization of power so that more units could be run in the form of enterprises. We hope all the localities and departments will work out their plans for building their own patent structures and then submit them to their own leading departments for approval so that this task may proceed according to plan. During the seventh 5-year plan, all localities and departments should make an effort to set up a number of patent business offices and patent document service centers.

To ensure the implementation of plans for building patent structures, we hope the state and the localities will give priority to these plans in the supply of money, materials, and manpower and treat them as projects for intellectual development.

The process of building a patent structure is also a process of self-improvement for the structure itself and for China's patent system. This task is very arduous, and the difficulties are many. However, we must understand that the available conditions for us to set up patent systems are a reflection of the state's prosperity and its march toward the goal of modernization. We must arouse the enthusiasm of a billion people in invention-creation, fully utilize all the intellectual resources that can be utilized in the world, and take legal and economic measures to promote technical progress. This is the natural development of China's modernization program. For the cause of patent work, the responsibility is heavy and the road ahead is tortuous. As patent workers, however, we must have a sense of glory in our responsibility for and our dedication to this cause, as well as the determination and courage of pioneers to do the work well. I believe that our comrades can hereafter gain

more useful experiences in their work, and make their contributions in building patent structures with Chinese characteristics.

#### B. Strengthen the patent work of enterprises

The vitality of a patent system comes from two sources: first, the scientific research organs, universities, specialized colleges, and enterprises which encourage invention and creation; and second, the enterprises on which the popularization and application of inventions and creations mainly depend. Enterprises play an important role both in the birth of inventions and creations and in their popularization and application. Therefore, the patent work of enterprises is the foundation of all patent work.

Now that the reform is in progress, the enterprises will be subjected to a stern test resulting in the survival of the fittest. The economic results of many enterprises in China are poor, the quality of their products is inferior, the specifications of their products are not popular, and their competitive power on the international market is weak. An important way to solve these problems is to accelerate the enterprises' technical progress. In view of the present realities of China's enterprises, therefore, there is an objective need for patent work to be developed. Conscientious implementation of the patent law should be an important aspect of the reform of enterprises at present, and we must protect the patent rights for inventions-creations, and respect the legitimate interests of inventors, designers, and patent right holders.

We believe that the industrial enterprises should do the following jobs in patent work:

1. The patent law should form an important part of the program of legal knowledge popularization. The leadership of enterprises should take the lead in studying this subject, which should also be included in the subjects for future state examinations of enterprise managers and factory directors. The leadership and the workers and staff members should strictly observe the patent law.
2. In studying the development of new technologies and new products, or in carrying out technical transformation, the enterprises should also search for novelty. First, they should search China's patent documents. In adopting the inventions-creations that are protected by China's patent law, they must obtain the permission of those who have the patent rights instead of making any unauthorized use. To prepare the products for entry into the international market, they must also search the international patent documents to be sure that they are original and will not infringe on other people's rights.
3. In importing patented technologies, we must investigate their legal status. Patent protection has regional and time limits, and no patent can be valid in any country indefinitely. Therefore, it is very important that the legal status of any technology, that is patented, be investigated. Because of the lack of patent knowledge in the past, we did not investigate the legal status whenever patent problems were encountered in importing technologies.

As a result, technologies with invalid patents, or basically unpatented technologies were accepted as having valid patents, and unnecessary economic losses were incurred. Such losses must be avoided in the future.

4. The filing of applications for patent rights and the exploitation of the patented technology should be organized at the proper times by the enterprise concerned. The enterprise, whose inventions-creations conform to patent law requirements and need patent protection, must file applications for patent rights in good time. Which of the inventions-creations are qualified for patent rights and need the filing of patent right applications? When should such applications be filed? Is it necessary for such applications to be filed in foreign countries, and, if so, what foreign countries are they? The enterprise must carefully consider all these questions and make the correct decisions or policy decisions. After legally obtaining the patent rights, the enterprise must promptly organize the invention-creation exploration or permit others to exploit them, in order to obtain optimal economic benefits.

5. Patent information should be fully utilized. Enterprises should pay attention to the use of technical information, including the patent documents, and guide the scientific and technical personnel and the technical innovation activists conducting fresh inventions-creations on the basis of absorbing and digesting the present technologies. In the course of research and exploitation, and based on patent information, it should continue to readjust the orientations and programs of research and exploitation, and to study the relevant patent policies.

In setting up the goals of development and making policy decisions in business operations, the enterprise should make use of the technologies, products, and information provided by patent documents so that these policy decisions can be scientific, perceptive, and strategic in nature. The role of patent information in transforming an enterprise from being one of solely productive to one of the productive, trading, and pioneering type should also be given full play.

Enterprises must carefully monitor the trend of foreign patent applications which may affect themselves, and should oppose those which should not be approved. Any patent that has been granted in error should be cancelled through the invalidation procedures, and any action that may infringe on an enterprise's patent rights should be dealt with according to law. Our enterprises abroad should treat the trend of patent rights of other enterprises in the same trade as an important sign of business competition which should be carefully noted. We cannot afford to overlook this important sign.

An enterprise must have a special department or some special personnel to handle patent work, if it wants to succeed in this task. Industrial enterprises of all types should designate a deputy factory director, or the chief engineer to take charge of this work. It may either set up an independent patent department or assign some person to take charge of it on a full time or a part time basis according to the requirements and the conditions in the enterprise. The persons designated for this work must have been trained in patent work.

The departments in charge of economic affairs or science and technology at all levels should collaborate with the patent department in providing guidance for the enterprises and developing their patent work in a practical way.

In this meeting, we have distributed the "Decision on Strengthening the Patent Administration Organs (Discussion Draft)" for general discussion. After its revision on the basis of a consensus, it will be signed and forwarded jointly by the State Economic Commission, the State Science and Technology Commission, and ourselves.

### C. Preliminary Modernization of Patent Handling and Information Processing

After centuries of development and evolution since its birth, the patent system has become a modernized system for the management of scientific and technical achievements on a global scale. China's patent system has also provided a modernized system for the management of scientific and technical achievements. Without this system, it would be impossible for us to create for these achievements such a complete and systematic file with unified specifications and fully open to the public; or to establish a scientific and technical information system to serve scientific and technical as well as economic development. The modernization of management methods calls for modernized management facilities. Inventions and creations are now counted in terms of hundreds of thousands or millions each year, and it would be difficult for us to meet the requirements of either the processing, dissemination, or use of information with the traditional manual methods and printed forms. This difficulty was keenly felt by the industrially developed countries long ago, and they began to use computers in business transactions, document retrievals, and documentary services 10 ago or even earlier. The patent office of the United States, Japan and Europe are now developing a paperless system which will become completely computerized in the examination and approval of patent applications and the management of files. We are already feeling the same difficulty although our patent work is just beginning. The time-consuming process of printing application documents, the low efficiency in handling business matters, the frequent occurrence of mistakes, the long publication periods, the poor circulation of information, the shortage of personnel, the limited space for document storage and some other problems are now becoming increasingly obvious. To solve these problems, apart from raising the standards of management and the efficiency of personnel, we must modernize the facilities for management. During the seventh 5-year plan, we will have to rely on our own resources and at the same time seek foreign cooperation to achieve our modernization. Our goals are as follows:

1. Computerized management of the patent work flow. Our plan consists of the following two steps: First, with microcomputers, we will set up a local area network to solve the problems of handling business matters, monitoring expenditures, and compiling various numerical statistics within limited times. Besides solving these problems, the local area network can also provide the necessary facilities for every patent administration department to supply application data internally and to solve the problem of information circulation. When the local area network has been set up and is operating

well, we will take the second step by forming a unified business handling system of the China Patent Bureau so that in 1990, computers will be used in the entire process of application, examination, approval, and publication.

2. Active development of the electronic documents in application. Within this year, we should make an effort to devise some plan for the gradual introduction of floppy disks or magnetic tapes in patent right applications. It is proposed that some agencies dealing with foreign countries should take the lead in this introduction, to be followed by some large patent agencies. The Patent Bureau will set up an input service organ to solve certain sundry input problems in application, off-line at first, and on-line later. The use of electronic application documents can be combined with electronic sorting [zhao pai 3564 2226]. The thickness of the technical manual can be reduced by one-third to one-half with corresponding reduction in the cost of patent documents. Application with electronic documents is now developing throughout the world, and we should conduct some active exploration in this direction.

3. Preparations for a data base for the retrieval of abstracts of international patents in Chinese. An agreement of technical cooperation has been signed with Japan, and our efforts during the seventh 5-year plan will be directed at these preparations in order that the project can be completed during the eighth 5-year plan. At the same time, we will increase the number of terminals hooked up with the international patent document data base network. The formation of a data base for Chinese abstracts is quite time consuming. However, if it can be set up, it will be of great help to not only patent work, but also to economic and scientific and technical pursuits.

4. Exploring the avenues for high-density storage of patent documents and striving for the completion of an experimental storage system for China's patent documents in optical disks during the seventh 5-year plan.

While computerizing the handling of business matters and the processing of patent information, we should also make an effort to have the patent documents microfilmed. This is an important way to modernize information processing and the most modern means of storing patent documents in full text permanently. The document service center of the Patent Bureau has already set up several microfilming workshops and begun to distribute China's patent documents in microfilms. During the seventh 5-year plan, the document service center of China's Patent Bureau, and the branch centers at various levels will mainly rely on microfilms as a supplementary aid in storing foreign documents.

The modernization of patent information processing is a project for systems engineering which requires tremendous intellectual and financial resources. We have paid great attention to this project since the time of our preparatory work for the patent system. Under actual conditions, however, we still have to exert great efforts in order to attain this objective during the seventh 5-year plan. The Patent Bureau has set up an automation committee and mobilized nearly 30 software and hardware workers to develop this project.

Attainment of this objective is but the first step in the modernization of our patent work. A large volume of work will still be left for manual operation, and paper will remain as the main carrier of patent information. Manual

operation cannot be eliminated during the seventh 5-year plan, or entirely eliminated during the Eighth and the ninth 5-year plan. While creating the conditions for the modernization of information processing, therefore, we should also strengthen the system of classified files and improve the publication and distribution of patent documents, all in printed forms. The Patent Document Publishing House has done its best to lower the cost of the bulletins and technical manuals for China's Patent Bureau, and given some preferential treatment for the patent system. The document service departments are also trying every way to make full use of the documents. In the past, we proposed that the work of patent documentation should have the characteristics of being Chinese in style, systematic, professional, microfilmed, and computerized. This task must be fulfilled step by step. On the one hand, we must closely watch the trend of international developments and grasp the up-to-date technologies of document modernization. On the other hand, during the seventh 5-year plan, we must lay the foundation for further modernization during the eighth and the ninth 5-year plan.

#### D. Continued Improvement of Patent Statutes

Since the announcement of the patent law and the convention of the first patent work conference, the State Council has successively approved the "Regulations on Implementing the Patent Law" and the "Provisional Regulations on Patent Agencies." Based on these regulations, the Patent Bureau has worked out a series of rules and regulations of implementation. The localities and departments have likewise worked out regulations appropriate for their own conditions to guarantee the smooth implementation of the patent law.

Judging from its implementation and the reactions from foreign countries, China's patent law, we dare say, is a modern law suitable for China's national conditions and consistent with international practice. However, since this is the first time for China to enforce a patent system, and because of the new world technological revolution and the unprecedented popularity of industrial property systems in every country, China's task of patent legislation during the seventh 5-year plan is still very arduous.

1. We must continue to work out the statutes for the implementation of the patent law so that there will be rules and regulations to go by in the solution of actual problems. The units, in which the required conditions are ready, can proceed with the formulation of these statutes, while those which are in urgent need of these statutes even though the conditions are not yet ready for them can first use them internally and on a trial basis until sufficient experiences have been accumulated and the conditions are ready. Then formal statutes can be announced. This was how the "Basic Criteria for Patent Examination" was produced: for internal reference at first; revised on the basis of a consensus after several years' practice; and formally announced when conditions were ripe. If conditions are not ripe for a uniform set of regulations to be worked out on a national scale, the localities and departments can first work out their own on limited scales. Because of the different conditions in different localities and departments, we cannot arbitrarily insist on uniformity for some regulations. For example, the agency fees are higher in some, lower in others, and exempted in still others, and this situation will remain until a uniform set of regulations are worked

out when conditions permit. The regulations on implementation must be in line with the principles behind the patent law. The formulation of uniform regulations takes several years because the problems in all quarters must be considered and repeatedly deliberated upon before the regulations can be examined and approved by the NPC Standing Committee. As state laws, they should be relatively stable. Therefore, they cannot be overlooked because of a certain incident at a certain time. Furthermore, we must conduct full investigations and certain soft scientific research in advance to be sure that they are well coordinated with other regulations, and consider the situation more thoroughly from a macroeconomic point of view. Because the demarcation line between service inventions-creations and nonservice inventions-creations is not clear and disputes are fairly frequent, the Patent Bureau has proposed to the State Council that a set of service invention laws be formulated. The State Science and Technology Commission has included the suggested laws among the subjects for soft scientific research. We hope that after due investigations and study, a set of laws which are able to correctly readjust the relationships among the state, the collectives, and the individuals and which are fairly specific and practical will be worked out.

The patent administration organs did a great deal of work in the past 1 or 2 years in the formulation of regulations on implementation. We hope that during the seventh 5-year plan, all these regulations, especially those dealing with the infringement of patent rights, will be perfected. The seventh 5-year plan will be the period to test the ability of the patent system in protecting patent rights. Aside from the mediation in and trial of cases of infringement in the people's courts, the same actions by the patent administration organs will further safeguard patent rights. We must gain and accumulate our experiences in practice in order to work out these regulations.

2. We must study and work out new statutes specially for protecting such new technological fields as bioengineering, integrated circuits, and computer software.

3. We must study the problems in the protection of chemical substances and drugs and the other problems in the implementation of a patent law. We expect to revise the patent law, the regulations on implementing the patent law, and the provisional regulations on patent agencies in 1990, after 5 years' practice during the seventh 5-year plan.

4. We will study whether China should join the Patent Cooperation Treaty, the Budapest Treaty, and the International Patent Classification Agreement.

#### E. Continued Intensification of Propaganda and Training in Patent Work

Our propaganda and training in patent work have been a great success in the past several years. These activities should be continued and intensified during the seventh 5-year plan.

We should continue to popularize patent knowledge as the first part of our propaganda work, and our efforts in this respect should be concentrated on the enterprises, especially the enterprise leadership, during the seventh 5-year plan. The second part is to raise the standards of knowledge on the basis of

popularization. In addition to general knowledge, we should teach different special features of patent work to different classes. There should be diversified means of propaganda. Besides continuing to enlist the support of the mass media and the publishing trade--so that we can make full use of broadcasting, television, newspapers, books, and magazines, and continue to publish various periodicals for internal circulation--and holding various types of training classes, we can also use videotapes, films, exhibitions, consultation services, and other lively forms of propaganda. The substance of propaganda must be to the point, and particular attention must be paid to the use of typical examples, both positive and negative, in China and especially the locality or departments concerned, to illustrate the meaning of patent protection. If by 1990, the leading bodies of all scientific academies and institutes, all universities and specialized colleges, and all large and medium-size enterprises will have someone who really understands patent work, our propaganda will be considered a great success.

In short-term training during the seventh 5-year plan, we should pay attention to two major tasks. First, the training of all the personnel in the patent system, including the Patent Bureau's personnel. Our patent work is now only beginning, and we can only afford to study while working and continuing to improve ourselves. This type of training should be arranged by the units themselves. This year, in coordination with the evaluation of the agents, the agency department of the China Council for the Promotion of International Trade, and the China Patent Agency Company have arranged for all personnel to study by leaving their posts. This is very useful in increasing the personnel's competence and then improving the quality of applications. The Patent Bureau has established a college of advanced study in Shanghai for patent administration cadres, and has held several training classes. In Yantai, it is planning to establish a training center which may hopefully be in operation next year or the year after. During the seventh 5-year plan, arrangements will be made for the systematic training of the cadres engaged in patent administration, patent agency, document searching, license trading, and so forth. In addition, the Industrial Property Research Association has organized a report meeting on the basic criteria for patent examination, an academic discussion, an academic report meeting, and a get-together of examiners and agents for study and discussion. These are also good ways to improve the quality of training, and should be encouraged. Second, the training of patent workers in enterprises. Since we want the patent work of enterprises to start on an all-out basis during the seventh 5-year plan, the task of training patent workers will be a very arduous one. We hope all localities and departments will consider this an important task and attend to it carefully. If necessary, the Patent Bureau can support them by sending out some of its personnel. For the subjects to be taught during the training of enterprise patent workers, we may refer to the program summary used for the training of patent agents. After passing the examination, the trainees will be certified by the Patent Bureau as qualified patent workers and be competent to represent their units in dealing with the Patent Bureau in matters of patent application.

The State Education Bureau has attached great importance to long-term and regular training, and accordingly worked out a preliminary plan. We ardently hope that the bureau will be able to supply the first lot of professionals for

various patent work fronts. The Patent Bureau will establish a patent law research institute, and hope to create the necessary conditions for a number of graduate students to be recruited during the seventh 5-year plan.

Furthermore, beginning in the second half of this year, 1 year's time will be devoted to an evaluation of patent agents. This evaluation will be conducted under the leadership organized by the patent agents evaluation committee. Based on the "Provisional Regulations on Patent Agencies," this committee will be formed of the representatives of the Patent Bureau, the Ministry of Justice, the State Education Bureau, the China Council for the Promotion of International Trade, and the patent administration organs. The regulations of evaluation has already been issued, and the comrades know all about it. We hope the business offices of all administrative organs will follow the example of the agency department of the China Council for the Promotion of International Trade and the China Patent Agency Company in conducting along with the evaluation a training course for the improvement of the agents, because the ultimate objective of the evaluation is to increase the efficiency of the workers and to improve the quality of applications. In consideration of the possibility that those comrades now engaged in administrative work in administrative organs may later may take up patent agency as a profession, the Patent Bureau will, after their evaluation, issue certificates recognizing their qualification as patent agents. If they need to work as patent agents because of job changes later, they will be given patent agent licenses. As to the qualification of patent agents as lawyers, we are still conducting discussions with the Ministry of Justice which is giving this matter serious consideration. We hope the Ministry will support the patent work and settle this matter while readjusting the lawyers' organizations and ranks.

As to the question of titles in patent technology, we have already worked out our program for submission to the authorities, and the Science and Technology Cadres Bureau has given it close attention. The question is now being studied, and further measures have to be withheld pending reply from the Job Titles Reform Leading Group and the Ministry of Labor and Personnel.

Comrades: Patent work is a new undertaking, to which the party and the state have attached great importance. It will play an important role in China's four modernizations. In his report on the seventh 5-year plan, Premier Zhao Ziyang said that we should continue to attach strategic importance to the advance of science and technology and to the exploitation of intellectual resources. He also clearly stated that we must conscientiously implement the patent law. To those comrades engaged in patent work, these remarks are indeed inspiring and at the same time point out their heavy responsibility and the long and arduous struggle ahead of them. The comrades here are the pioneers of this undertaking, and are responsible for a glorious and arduous task. As long as we firmly uphold the reform, strengthen the two civilizations, conscientiously implement the patent law, and work hard to add bricks and tiles to the great patent mansion of our socialist motherland, we can certainly contribute to the economic and technological development of our motherland. Our undertaking will certainly flourish. Thank you, everyone.

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C30: 4008/2043

## NATIONAL DEVELOPMENTS

### ROLE OF INTERMEDIARY ORGANIZATIONS EXPLAINED

Tianjin JISHU SHICHANG BAO in Chinese 25 Nov 86 p 1

[Article by Huang Chengming [7806 2110 2494]]

[Text] Intermediary organizations play an important role in selecting the environment which is optimal for economically beneficial production, for choosing products which are suited to the needs of the economy and of society, and in choosing the production unit best suited for producing technology commodities -- the research organization. The principal function of the intermediate organization is to organize and promote the products of the laboratory and bring them along to the production stage. These organizations may take an advanced technology from abroad or from an advanced area and introduce it into a backward region or into China. An intermediate organization might license Chinese technology abroad or bring technical problems that have appeared in the course of socio-economic development and bring them to the S&T sector and encourage scientific research and R&D. Thus intermediary organizations must be sure of the reliability and maturity of the product and the investment the purchaser is willing to make to put it into production. The intermediary organization must constantly survey supply and demand on the technology market and seek to understand the capabilities, characteristics, the economic benefits, requirements for putting it into production, the licensing fee, the method of licensing, and services after the results of the research are delivered to the purchaser. The intermediary organization should understand the requirements of the purchaser, as well as the present or potential conditions, capital, technology, equipment, market prospects for the finished products as well as the management ability of the purchaser in order to handle many different kinds of technological trade and to set up negotiations between the buyer and the seller. The intermediary must agree to keep confidential the technical and economic aspects of the agreement. The intermediary should honestly describe the situation and problems of the other party to each side, eliminate ambiguities, clarify the responsibilities, rights, and advantages of each party. Thus the two parties will be able to reach an agreement which is easy to implement, fair and mutually beneficial agreement. After the technical product agreement is made, the intermediary organization should check to see that the agreement is being properly implemented at proper intervals. If problems appear the intermediary organization should arrange for negotiations to ensure that the agreement is carried out properly. All this demonstrates that the intermediary organization is an important and indispensable link in the trade of technology.

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CSO: 4008/2039

## NATIONAL DEVELOPMENTS

### CONSTRUCTION MATERIALS INDUSTRY CONFERENCE

Tianjin JISHU SHICHANG BAO in Chinese 11 Nov 86 p 1

[Article by correspondent Tian Guohua [3944 0948 5478]]

[Text] The 6-day National Construction Materials Conference ended on 6 November 1986 in Chongqing. The conference stated that the seventh 5-year plan revived China's construction materials industry; that China should develop its trade in technology on both the Chinese and the foreign markets; and that a new situation should result from high tech products and technology exports.

According to incomplete statistics, trade in construction systems technology exceeded 53.8 million yuan and technical exports began to become significant. The representatives at the conference believed this was still not enough. China should import and export technology. In the past China paid more attention to domestic than to foreign technology. If the foreign market was studied at all, it was with an eye to imports rather than to exports. We must expand our vision; we should strive to open up the foreign technology market as well as the domestic market. Currently Chinese building materials technology lags far behind the advanced industrialized countries although not in all areas. China has developed some unique technologies which is very suitable for the developing countries. The representatives at the conference believe that China, by continuing to advance on the basis of technology contracts and the export products incorporating new technologies, should compete in the international technology market to earn foreign exchange and win honors for the Chinese homeland.

During the conference an association to promote the construction materials technology market was organized.

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## NATIONAL DEVELOPMENTS

### UNIFICATION OF MANAGEMENT UNDER S&T COMMISSION

Tianjin JISHU SHICHANG BAO in Chinese 11 Nov 86 p 1

[Unattributed article: "Work on Reforms of S&T Allocations System Proceeds Smoothly; State S&T Commission, After Allocating Research Funds to 53 Departments of the State Council, Sets Guidelines for This Year's Research Budget According to the Principle of Management by Category"]

[Text] The wide-ranging reforms which have been carried out over the past 6 months to reduce centralized funding of research at S&T organizations and in the establishment of a system to support basic research in the natural sciences as well as some work in the applied sciences has proceeded smoothly and produced good results.

As of July 1986 the work of unifying, under the State Science and Technology Commission, the authorized management of 53 science research departments which were originally financially managed by the State Council, has been completed. The State Science and Technology Commission has already transferred 10.5 billion yuan in accordance with the principle of management by category. The State Science and Technology Commission also set budget guidelines for this year's research work for all departments. The State Council also decided to complete the transfer of funds from the NDSTIC and the splitting up of what formerly were the Military Research Institutes. Next year these institutes can be included in the reform of the S&T system of the entire country.

After completing the allocation of funds to each of the 53 departments of the State Council, the State Science and Technology Commission began to classify the various research institutes and to design a classification system. Working closely with each department, the State Science and Technology Commission has classified 631 central research institutes. Taking the research of 30 work exchange bureaus as an example, 58 percent were engaged in developing technologies, 13 percent had several different types of work, contract work accounted for 29 percent. Reforms in classification and research allocations will be performed for local research institutes as well. Work is proceeding most rapidly in the provinces and municipalities of Sichuan, Shanghai, Guangdong, Shanxi, Harbin and elsewhere. The leadership is taking a personal interest in the reforms and established some concrete measures. It is expected that the allocation and classification work will be completed by the end of November.

The reform in the system of basic scientific work involves the critical evaluation by the State Natural Science Funding Committee in order to select superior basic science and some applied science projects. The funding Committee has received 12,000 grant applications so far. The funds requested a total 1.2 billion yuan. Criticism by colleagues is being phased out and is being replaced by criticism by experts. This year the R&D funding for each department of the State Council increased by 5.07 percent. The money allocated centrally will decline by 10 percent and the State Science and Technology Commission will use the difference plus additional funds to provide interest-free loans to each department in order to support their R&D work. Funding will increase 5.5 percent for S&T services contract work. Funding for research work will be divided into overhead and research funding; overhead will increase 5.5 percent while research funding will be gradually taken over by the State Natural Science Funding Committee. This year only 1-2 percent of the research funding will be allocated through the State Natural Science Funding Committee. Thus overall funding for the different types of S&T work -- developing technology, basic research and S&T services -- will increase rather than decrease.

The State S&T Commission is energetically carrying out the reforms, assimilating and improving the fruits of the reforms and establishing policies on the allocation of funds and on management methods.

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## NATIONAL DEVELOPMENTS

### DELEGATION HEAD ON S&T IN UNIVERSITIES

HK190833 Beijing XINHUA Hong Kong Service in Chinese 1515 GMT 18 Feb 87

[Interview with Huang Xinpai, head of a scientific and technical delegation embracing 14 Chinese universities and chairman of the China United Scientific and Technological Joint Center, by Ou Yueying [1448 2588 5391] in Hong Kong on 18 February]

[Text] [Question] What results do you expect to gain by introducing scientific and technical achievements from China's universities?

[Answer] In recent years, exchanges between Chinese universities and colleges and universities in Hong Kong have become increasingly frequent. It is the first time for us to brief industrial, commercial, scientific, technical, and education circles in Hong Kong on our scientific and technical achievements on such a large scale. This shows a new development in scientific, technical, and economic exchanges between universities in the mainland and Hong Kong.

We hope that Hong Kong manufacturers and entrepreneurs will be interested in parts of our scientific and technical achievements, and hope that we will establish still closer links, and promote long-term exchanges. With the aid of Hong Kong as an international trade, financial and information center, we wish to speed up the work of commercializing our universities' scientific and technical achievements, and to open up international markets. We also hope that our scientific research achievements will be helpful to the manufacturing sector and other trades in Hong Kong in attaining a still higher level with regard to the use of advanced science and technology, and in enhancing the competitiveness of their products in international markets. We are determined to exert our efforts for our common interests.

[Ou] What is the position of university scientific research work in the country as a whole?

[Huang] There are 1,016 higher-education institutions in China. Some 759 colleges and universities offer science, engineering, agricultural, and medical courses. We have 76,000 scientists, senior scientific and technical personnel, and engineers working in higher-education institutions, accounting for 32.9 percent of the total number of scientific research personnel working in scientific research organizations above the county level throughout the

country. In addition, there are 75,000 graduate students in higher-education institutions.

A number of Chinese higher-education institutes play the role of educational and scientific research institutions. They pursue a guiding principle of integrating research in basic and applied sciences. They make achievements every year. The number of natural science awards issued by the state for scientific and technical achievements made by higher-education institutions in 1982 accounted for 45.9 percent of the total. During the period from 1979 to 1985, some 24.8 percent of invention awards issued by the state went to higher-education institutions. All this shows that the scientific research force in higher-education institutions occupies a decisive position.

[Qu] To what extent has progress been made by higher-education institutions in turning their scientific research achievements into commodities?

[Huang] In accordance with the guiding principle formulated by the state that "economy must rely on science and technology, and science and technology must cater to the needs of economic construction," in recent years Chinese higher-education institutions have vigorously strengthened their technical development work in order to serve economic construction and market demand. Some of them have established organizations aimed at promoting scientific and technical development, providing consultative services, and so on. They have signed contracts with other units on scientific and technical work, provided scientific and technical consultative services, undertaken personnel training, and so on. More than 30 higher-education institutions have cooperated with industrial units to establish over 300 integrated bodies responsible for teaching, scientific research and production. In 1985, higher-education institutions countrywide signed 7,077 contracts with industrial units with a value of more than 20 million yuan. During the period from 1981 to 1985, the economic results obtained from popularizing scientific research achievements were valued at more than 2.3 billion yuan.

In addition, some new products manufactured on the basis of using higher-education institution technical achievements are also fairly competitive on the international market. For example, the KTP laser frequency multiplier crystal produced by Shandong University in 1986, and urease produced by Nanjing University sell well in Japan. The United States has placed an order for conversion agents for exhaust automobile gases produced by the East China Chemical Engineering Institute.

[Qu] What role will be played by the China United Scientific and Technological Development Center?

[Huang] The purpose in establishing the United Scientific and Technological Development Center is to give play to the strong points of universities and colleges in terms of their personnel and technology. They should be organized to become a systematic development force in order to promote the commercialization of scientific research achievements and open up markets both at home and abroad. This united development center is composed of 39 higher-education institutions and 2 scientific research units, with headquarters in Beijing. Cooperation with enterprises both at home and abroad is welcomed.

## NATIONAL DEVELOPMENTS

### QINGHAI TO PROMOTE S&T REFORM

HK231045 Xining Qinghai Provincial Service in Mandarin 2300 GMT 22 Feb 87

[Text] The Provincial Science and Technology Association has decided to speed up reform of the scientific structure this year, to firmly grasp the implementation of priority science and technology projects and spark plan, and to make new contributions to invigorating Qinghai's economy.

In an interview with our station reporter, a responsible comrade of the provincial Science and Technology Association said that while carrying out structural reform this year, all scientific research organs must continue to promote the development of scientific and technological markets and accelerate the pace of commercializing technological achievements. Scientific research units must also take a new road in scientific and technological funds, employment of persons on technological posts, reasonable transference of talented people, patent work, management of scientific and technological achievements, and foreign affairs involved in science and technology work.

He said that this year the provincial Science and Technology Association will mainly focus on the implementation of priority scientific and technological projects, such as animal husbandry, the salt chemical industry, the light and textile industry, commerce and the implementation of the spark plan. In particular, it will spread the technological achievements that can yield fast and effective results to the rural and pastoral areas. The Scientific and Technological Association will send a large number of scientific research personnel to the rural areas and factories to help township enterprises and medium-sized and small enterprises grasp the advanced technology and management experience as soon as possible.

The responsible comrade disclosed that this year, scientific research departments under the provincial Science and Technology Association will also stress studying herdsmen's settlement points, house design, interior housing facilities, food structure and dietetic ways; actively promote the use of new tents, small wind-driven generators, and mini-hydropower generators; and help herdsmen and peasants with proper use of solar energy, wind energy, marsh gas, and terrestrial heat. To meet peasants' demand for studying science, the provincial Science and Technology Association has decided to train 3,000 rural youths and grass-roots cadres.

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## NATIONAL DEVELOPMENTS

### GUANGXI TECHNOLOGICAL PROGRESS DURING SIXTH FYP

HK051410 Nanning Guangxi Regional Service in Mandarin 1030 GMT 4 Jan 87

[Excerpts] The fourth regional conference on enterprise technological progress opened in Nanning today. Regional People's Government Vice Chairman Wang Rongzhen spoke at the conference.

In his speech, Vice Chairman Wang Rongzhen reviewed the achievements scored by our region in technological progress during the Sixth Five-Year Plan and in 1986. He said: The region's investment in the technological transformation of the existing enterprises during the Sixth Five-Year Plan was 2,478 million yuan and the newly-increased fixed assets 1.8 billion yuan, which was equal to 26.82 percent of the original value of the fixed assets of all state-run enterprises throughout our country at the end of 1980. Through technological transformation, a large number of enterprises markedly improved their technological level, equipment level, and the quality of their products and expanded their productive capacity. This has laid a foundation for continuous economic development during the Seventh Five-Year Plan.

In his speech, Vice Chairman Wang Rongzhen pointed out: Our region must make a new progress in technological progress in 1987. The state has arranged 820 million yuan for the technological transformation of Guangxi this year, which is 51 percent more than last year. The state has arranged special funds for 98 technological transformation projects of our region and the investment in them this year is some 200 million yuan.

Wang Rongzhen said: Whether this task is completed well or badly will directly affect the scale of the technological transformation of our region in 1988 and the speed of economic development for the last 3 years of the Seventh 5-Year Plan. Therefore, we must take measures and try in every possible way to fulfill and overfulfill the tasks handed over to us.

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## NATIONAL DEVELOPMENTS

### BRIEFS

**PROGRESS IN SEISMIC DATA ANALYSIS--**[Special to CHINA DAILY Li Su] A seismic data processing system for use in oil exploration, using the China-made super-computer "Galaxy," went into operation in a country in Hebei Province yesterday. The system was designed and manufactured by Chinese specialists from the Ministry of Petroleum Industry and the State Commission of Science, Technology and Industry for National Defence after four years of effort. The system uses a "Galaxy" main computer which can handle 100 million bits of information a second. To date, China has compiled a huge amount of seismic prospecting data and has been inefficient in processing it using ordinary computers. In a trial operation, which lasted for about a year, the system handled seismic prospecting data from oilfields in Liaoning, Hebei, Heilongjiang and other provinces and proved highly efficient. The system passed the State appraisal on Wednesday. The authorities maintain that the system's successful operation will provide accurate data for oil exploration and will be highly useful to China's oil industry. [Text] [Beijing CHINA DAILY in English 13 Feb 87 p 1 HK] /6662

**FLOPPY DISK PRODUCTION LINE--**The Fujian, Jiangxi and Hong Kong joint venture, China Electronic Company Ltd, recently imported China's first electronic computer floppy disk production line. Currently the production line's annual production capability is 0.6 to 1.0 million disks and the product is beginning to enter the markets of such countries and regions as Pakistan, Hong Kong, Macau, and Singapore. [Text] [Beijing RENMIN RIBAO OVERSEAS EDITION in Chinese 30 Dec 86 p 1] 8226

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CSO: 4008/1038

## PHYSICAL SCIENCES

### RELATIONSHIP BETWEEN DEVELOPMENT OF HIGH ENERGY PHYSICS, INDUSTRY

Beijing WULI [PHYSICS] in Chinese No 11, Nov 86 pp 668-670

[Article by Xu Jianming [1776 1696 6900], Institute of High Energy Physics, Chinese Academy of Sciences: "Relationship of Development of High Energy Physics and Industry and Other Sectors"]

[Text] The development of high energy physics is inseparable from the support of industrial and other sectors, and only when the development of industry and the economy have reached a certain level is the development of high energy physics a possibility. On the other hand, the new products, new techniques and technologies developed in the process of developing high energy physics also can play a definite role in spurring on production of industrial and other sectors. Below we will briefly explain this role with regard to relevant materials domestically and those of the Western European Nuclear Research Center (CERN).

#### I. Some Situations Domestically

In 1956 China began to consider establishing her own high energy physics experimental base and in 1977 began to construct a high energy base. Up to now, primarily prefabricated research work has been carried out, and a construction project for a positron, negatron collider in Beijing has been started. Some results of high energy research work in the last 10 years have already been, or are just now being, applied in industry and other sectors. Some results still have not yet been applied because they have not been recognized by society or although some have been applied, they have not yet been collected completely. Here we will summarize only those primary situations which have been collected.

##### 1. High Frequency Microwaves

The proton high energy accelerator injector--a proton linear accelerator--and the storage ring of the Beijing positron, negatron collider are both 200MHz acceleration systems. The 1 5/8", 3 1/8", 9" and 12" high energy coaxial transmission lines developed for construction of the proton linear accelerator have been applied in the decimeter wave band color television (below, shortened to color TV) transmitters and relays. In addition, high frequency machine local control, remote sensing interface, photoelectric conversion technology and high speed protective crowbar circuits are already being used in decimeter waveband 10kW and 30kW color TV transmitters.

To satisfy the demands of storage rings for high frequency machine output power and high reliability, we have developed high power high frequency transmitters which can operate uninterrupted for long periods of time without breakdowns. This result may be used to improve the transmission power and operating reliability of color TV transmitters.

All-metal sealed high power waveguide components, high power standing wave ratio protection systems, and high power klystron and high power modulator technology may play a promotional role in other departments.

## 2. High Vacuum Technology

Due to the needs of high energy research, we have developed turbomolecular pumps with pumping speeds of 400 l/s and 1500 l/s; ion pumps with pumping speeds of 100 l/s, 400 l/s, 500 l/s, and 1000 l/s and ion pumps of 100 l/s and 500 l/s suited for ultra-high vacuum greater than  $10^{-10}$  Torr. We have also developed ultra-high vacuum measuring equipment, a variety of vacuum valves, and quick release flanges. This all indicates the development of China's vacuum technology. This equipment and technologies can be used in relevant industrial, scientific research, and other sectors.

## 3. Power Supply Equipment

To satisfy the demands of high energy accelerators and high energy physics detectors, power supply manufacturing plants have developed a power supply with stability of  $10^{-4}$ , and maximum current from several hundred to several thousand amps. This power supply can be regulated smoothly within a wide range. At the same time, they have also developed a highly precise current sensor and certain types of current generating equipment for large pulses. They can be used directly or indirectly in other sectors.

## 4. Computer Automated Control Technology, High-Speed Electronics, and Other New Technologies and Materials.

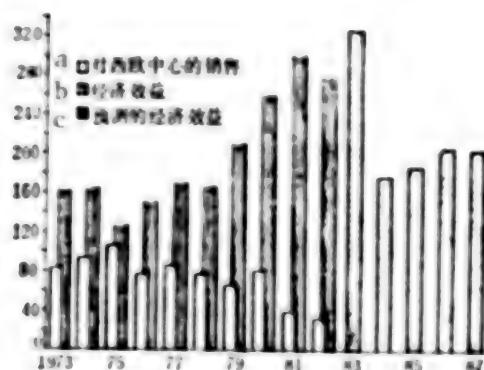
The computer automated control technology mastered in the process of constructing an accelerator has gradually spread to other departments. The CAMAC support system and general purpose NIM (nuclear instrumentation standards) series which were developed to meet the demands of high energy physics research have already been used in some departments and excellent results have been obtained. In addition, some new materials, new devices and new technologies have been developed on a trial bases, such as large area oxygen free layer combined steel plate, machineable ceramics, high luminosity electroplating, large volume high performance ferrite and heavy hydrogen thyratron, which can play a role directly or indirectly in other departments. In addition, research on permanent magnet technology also will spur on the development of such permanent magnet products as permanent magnet machines.

## II. Economic Benefits Provided to Related Enterprises by CERN Orders for Goods

The CERN organized by 12 Western European countries has been engaged in high energy research, instruments, materials and equipment was purchased from 6,000

plants, 519 of which provided high technology equipment. From 1973 to 1982, 1.38 billion Swiss francs were spent on purchases from these 519 plants. A survey carried out on 160 of the plants discovered that orders for high energy research produced economic benefits for these plants. The results of the survey show that, generally speaking, orders for goods for high energy research could produce definite economic benefits for plants providing high technology equipment.

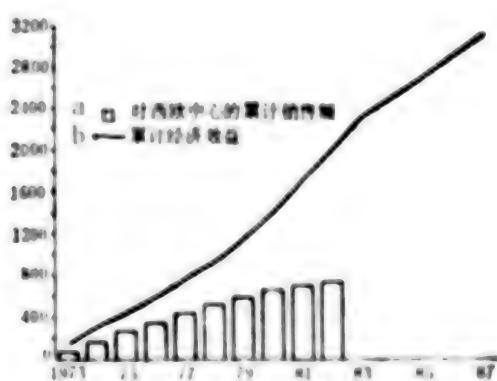
Figure 1: Annual Sales and Annual Economic Benefits of 160 Plants (in Swiss francs)



Key:

- a. Sales to CERN
- b. Economic benefits
- c. Projected economic benefits

Figure 2: Cumulative Sales and Curve of Cumulative Benefits of 160 Plants (in millions of Swiss Francs)



Key:

- a. Cumulative sales to CERN
- b. Cumulative economic benefits

The demands of product quality and control of equipment performance which high energy research makes are strict, thus improving the reputation of domestic products and strengthening the competitive ability of the products in domestic and international markets. For example, vacuum equipment manufacturing plants improved the product quality because of the demands of high energy research orders, and increased the competitiveness of the product in the international market. High energy physical experiments carried out by CERN provided long term testing ground for photoelectric multipliers, computers, computer networks and software. The results have spurred in improvements in quality of these products and raised confidence in the products. In addition, the new technology, new products, and new techniques developed to satisfy the demands of high energy research not only were used in other departments, expanded the manufacturing plant's sales volume, and increased economic benefits, but at the same time also promoted the development of other technology and increased the competitive ability of other products manufactured by related plants. For example, the CERN place strict demands on the reliability, life and optical performance of light guides and scintillators. To meet these demands, the manufacturing plants carried out technical reform and improvement for these special demands and these technological improvements put these plants ahead of others in the development of products which used solar energy. The above factors have improved the sales of plants which have taken on the task of manufacturing the high technology products required by high energy research. In addition, application of the results of some high energy research can also improve production, lower costs and increase the economic benefits of the manufacturing plant. The degree of economic benefits generated vary with industry and plant. Some plants can also experience a drop in economic benefits.

Someone surveyed the 160 plants, overall sales and overall economic benefits of these plants are given in Figure 1. Their cumulative sales and cumulative economic benefits are given in Figure 2.

Table 1 gives the sales ratios, economic benefits, and proportion between them of the 160 plants by industry. From the data in the tables it is clear that the differences between industries is considerable.

Extending the results of the survey of the 160 plants to the 319 plants which supplied high technology equipment, we can calculate the economic benefits to these plants in 1973-1987 from sales in the CERN between 1973 and 1987 at 4.08 billion francs. In terms of 160 plants, the economic benefits were approximately four times the sales of sales to high energy research. From 1973 to 1987 the gross expenses of CERN were 8,985 billion francs, thus the gross benefits of the 319 plants were 60 percent of the total expenses of the CERN in 1973-1987. See Figures 2 and 3 for the sales of the 160 plants by industry and the projected economic benefits and sales data.

Figure 4 shows the proportion of 160 of the industries in overall economic benefits, in which electronics and computers accounted for a total of 54.1 percent, vacuum freezing made up 9.3 percent, iron and steel and welding made up 6.1 percent, precision machinery made up 3.7 percent, and electrical equipment made up 16.3 percent.

The above materials are very incomplete and the degree of accuracy is also very low. However, these materials at least explain one question, i.e., development of high energy research can play a definite promotional role in industry and other sectors.

Table 1

	a	b	c	d	e	f
g. 经济效益	1140	745	300	190	65	2640
h. 损失	1.7	9.4	5.3	0.4	0.2	15.0
i. 销售额	229.3	859.2	101.3	35.8	9.2	747.6
j. 效益/销售	6.1	2.1	3.0	5.3	2.1	3.5
k. 工厂数目	57	46	22	16	19	160
l. 有效益的工厂数目	12	19	8	9	8	55

(in millions of Swiss francs)

Key:

- a. Electronics and computers
- b. Electrical equipment
- c. Vacuum and freezing superconductivity
- d. Iron and steel, welding
- e. Precision processing
- f. Total
- g. Economic benefits
- h. Losses
- i. Sales
- j. Benefits/sales
- Number of plants
- Number of plants without benefits

Table 2

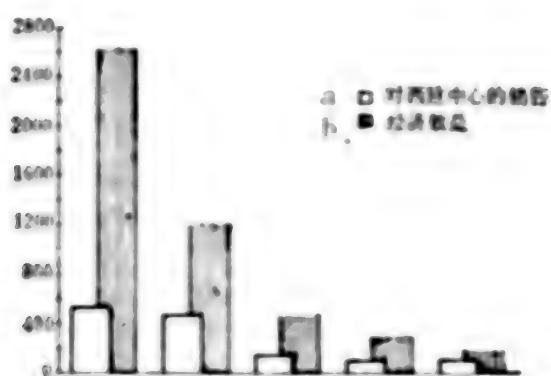
	a	b	c	d	e	f
g. 经济效益	2245	1025	400	255	195	4000
h. 损失	537.4	421.1	152.9	104.6	111.9	1175.4
i. 销售额	6.2	2.2	2.6	2.4	1.4	3.0
j. 工厂数目	189	130	34	65	103	519

(in millions of Swiss francs)

Key:

a. Electronics and computers	f. Total
b. Electrical equipment	g. Economic benefits
c. Vacuum and freezing	h. Losses
d. Iron and steel, welding	i. Sales
e. Precision processing	j. Benefits/sales

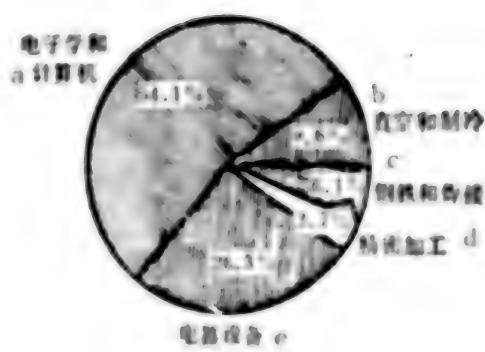
Figure 3: Distribution of Sales and Economic Benefits of 519 Plants Classified by Industry (in Swiss francs)



Key:

- a. Sales to CERN
- b. Economic benefits

Figure 4:



Key:

- a. Electronics and computers
- b. Vacuum and freezing
- c. Iron and steel and welding
- d. Precision processing
- e. Electrical equipment

This is a very natural phenomenon because in society, the branches of the sciences are interlinked and interact, the development of one branch depends on developments in other aspects and at the same time development of any aspect can influence other aspects.

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HYDRODYNAMIC VELOCITY-SPLITTING MODEL WITH A DEPTH-VARYING EDDY VISCOSITY IN SHALLOW SEAS: (I) THE VELOCITY-SPLITTING MODEL

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[Article by Song Lina [1345 7787 12'6], Institute of Physical Oceanography: "A Hydrodynamic Velocity-Splitting Model With a Depth-Varying Eddy Viscosity in Shallow Seas: (I) The Velocity-Splitting Model"; M.A. thesis directed by Feng Shizuo [7458 1102 460A]; paper received 22 April 1985; first paragraph is source-supplied English abstract]

[Text] Abstract: In the present paper, the three-dimensional problems for nonlinear tides, including tide-induced Euler residual currents, and for the ultra-shallow water storm surges, and for the Euler residual circulation, including the steady wind-driven circulation, are reduced to a second-order linear ordinary differential equation for the current with respect to the vertical coordinate. It should be pointed out with emphasis that the vertical-eddy viscosity coefficient is the physically acceptable arbitrary function of time-space coordinate, in special, including vertical coordinate. Based on the linearized problem, the current velocity can be split into three parts that may be called "the gradient current," "the stress current," and the "gravitational current," respectively. We can get an expression of vertical profile for the current which can be obtained by analytical or numerical approach. A partial differential equation for water level can be solved by the difference or the finite-element method. A generalized theoretical formula for the bottom stress is derived, which shows a linear relation between the bottom stress and the whole current and points out that a linearized model of vertical-eddy viscosity coefficient corresponds to a linearized law of bottom stress.

#### Introduction

Shallow seas dynamics research in shallow-water areas such as China's continental shelf seas and semi-enclosed marginal seas such as the Bohai, Huanghai, and Donghai Seas and the bays and river mouths adjacent to them not only has practical value for predicting water level and describing flow distribution but also has theoretical value[1]. Half-day or full-day tidal activity basically controls daily water level changes and flow distribution form, with tide levels and tidal flow having magnitudes of 1 meter and

1 meter/second, respectively. Ocean tides are closely related to the lives and production of the peoples living along the sea and people began to take them seriously a long time ago. The construction of dikes on the edge of the sea, reclaiming land from the sea, setting up sluices along the sea and at river mouths to restrain the tides, and draining fields and irrigation, and the rise and fall of tidal waters all have a very big influence on ships entering and leaving port and on navigation and cultivation near the sea. In these days of the energy crisis, tide-generated electricity has opened an important path[2]. In the above-mentioned shallow-water areas there is frequently storm surge motion, and the storm surge level and flow and the process time all can be viewed as having the identical magnitudes as tidal motion. Therefore, the appearance of storm surges seriously affects the normal tidal motion, especially when the combination of storm surges and tides happens to go beyond the high-tide stage and the actual water level so created and exceeds the "warning level" for that area so it can run wild. In just the 10 years of the sixties, China's Bohai Bay on the Bohai Sea and the Laizhou Bay shore have been hit by three large-scale typhoons creating tremendous disasters due to typhoon surges in the extensive easterly shallow seas due to the frequent passage of summer and autumn typhoons and the movement of northern cold tides and cold air southward during the winter and spring and the harm of typhoon surges caused primarily by cold tides and high winds in the Bohai and Huanghai Seas in the north[3]. From this it can be seen that research on tide and storm surge motion mechanisms and forecasting is important for China. In addition, after we carry out the time-averaging of the actual current velocity observed at a selected point in shallow seas over one or several tide cycles, we can obtain the residual constant current, i.e., the so-called "Euler residual current," and no longer has a tidal cycle. If we do not take storm surges into account, the current velocity magnitude (under ordinary circumstances) will be far smaller than the tidal current magnitude, that is, 1 cm per second to about 10 cm per second. However, it should be pointed out that although the residual current is far smaller than the tidal current in terms of magnitude, and it has a major relationship with the migration and transport of pollutants in shallow seas. Thus, research on the residual current plays an important role in environmental protection in the oceans and exploration of residual current undoubtedly is very important for China's environmental protection and prediction[4].

## 1. Physical Background

Using mathematical language to describe shallow-sea motion, a (dingjie [1353 6043]) problem made up of barotropic pressure shallow-sea fluid-dynamics equations and their corresponding sea surface and sea bottom kinematics and dynamics boundary conditions in the f-plane as below[3]:

Continuous equation

$$\frac{\partial u}{\partial x} + \frac{\partial v}{\partial y} + \frac{\partial w}{\partial z} = 0 \quad (1-1)$$

### Motion equation

$$\frac{\partial u}{\partial t} + u \frac{\partial u}{\partial x} + v \frac{\partial u}{\partial y} + w \frac{\partial u}{\partial z} - fv = -g \frac{\partial(\zeta - \bar{\zeta} - \zeta')}{\partial x} + \frac{1}{\rho} \frac{\partial \tau_x}{\partial z} \quad (1-2)$$

$$\frac{\partial v}{\partial t} + u \frac{\partial v}{\partial x} + v \frac{\partial v}{\partial y} + w \frac{\partial v}{\partial z} + fu = -g \frac{\partial(\zeta - \bar{\zeta} - \zeta')}{\partial y} + \frac{1}{\rho} \frac{\partial \tau_y}{\partial z} \quad (1-3)$$

Sea surface

$$z = \zeta$$

Kinematics boundary condition

$$w = \frac{\partial \zeta}{\partial t} + u \frac{\partial \zeta}{\partial x} + v \frac{\partial \zeta}{\partial y} \quad (1-4)$$

Dynamics boundary condition

$$\tau_x = \tau_{ex}, \tau_y = \tau_{ey} \quad (1-5)$$

Sea bottom

$$z = -h$$

Viscosity boundary condition

$$u = v = w = 0 \quad (1-6)$$

when  $(x, y, z)$  form the f-plane's right-hand right-angle coordinate system, and when the  $z$  axis is positive, the  $xoy$  plane coincides with the sea surface when undisturbed, and  $t$  is the time coordinate;  $(u, v, w)$  are current velocity in components on the  $(x, y, z)$  axis;  $\zeta$  is the water level calculated beginning with the undisturbed sea surface,  $(\tau_x, \tau_y)$  are the components of eddy shear stress at  $(x, y)$ , respectively;  $\rho$  is the seawater density,  $f$  is the (Keshi [2688 3044]) parameter, both of which are assumed to be constants in this paper;  $\bar{\zeta} = -\frac{p_a}{eg}$ , with  $p_a$  as the sea surface atmospheric intensity,  $g$  as gravitational acceleration, and  $\bar{\zeta}$  representing the forced function of sea surface atmospheric intensity;  $\zeta' = -\frac{\pi'}{g}$ , with  $\pi'$  as induced tide potential and  $\zeta'$  representing the forced function of induced tidal force;  $(\tau_{ax}, \tau_{ay})$  are the two components of sea surface wind stress on  $(x, y)$  axes; equation (1-5) shows sea surface shear stress continuous conditions; and  $h$  is the water depth of the undisturbed sea surface.

In this paper, density  $\rho$  is assumed to be a constant, i.e., the assumption of a "barotropic ocean," and a barotropic ocean is a special situation of a barotropic fluid. The introduction of this assumption is equivalent to eliminating the baroclinic motion situation (i.e., density is a function of temperature and salinity), the introduction of the f-plane is equivalent to ignoring the influence of the curvature of the earth, and this is precise enough for the motion in the few hundred-km horizontal-dimension barotropic shallow seas we want to study. Horizontal eddy stress is overlooked in

motion equations, because it is generally recognized that in barotropic shallow seas motion vertical eddy stress ( $\tau_x, \tau_y$ ) is far greater than horizontal eddy stress--which is equivalent to overlooking coastal viscosity boundary layers[3].

The shallow-seas fluid-dynamic model (1-1)-(1-6) obtained under the above-described assumptions still has a great deal of complexity--the nonlinear terms in the equation, especially due to the unknown form of eddy stress--so that the equation is not closed and cannot be solved. Generally the Boussinesq assumed expressed eddy stress ( $\tau_x, \tau_y$ ) is used to close this (dingjie) problem, i.e.,

$$\tau_x = \rho v \frac{\partial u}{\partial z}, \quad \tau_y = \rho v \frac{\partial v}{\partial z} \quad (1-7)$$

Equation (1-7) can actually be viewed as the result of extending the Newton's general law of friction to turbulent motion. Here,  $v$  is the motion eddy viscosity coefficient which is generally a function of motion. Thus (1-1)-(1-7) form a closed (dingjie) problem which describes shallow-sea motion. However, the nonlinear element in the equation turns it into a complex-eddy nonlinear problem, and generally speaking there is no way to arrive at a solution and if numerical methods are used for a solution, even today when electronic computers are highly developed, it is not realized. The currently popular "HN" method (a numerical method of fluid dynamics) corresponds to the overall current equations (1-1)-(1-3) or depth average equation[3, 5-7]. In addition to having to introduce a bottom friction experience law, this overall current form or depth average second-order space problem cannot arrive at a vertical distribution for current velocity. Thus, scholars in China and abroad have carried out research on third-order space models[8-10], including the contributions of cooperating scholars or graduate students of the Shandong College of Oceanology's Storm Surge Research Team--and this article is based on these achievements and hopes to make further developments.

Feng Shizuo (1977) proposed a nonlinear model for the three-dimensional tidal-space problem[11], and if we set sea surface wind stress and variation in atmospheric pressure in equations (1-1)-(1-7), i.e.,  $\tau_{ax} = \tau_{ay} = \zeta = 0$ , then (1-1)-(1-7) degenerate to a basic equation for this tidal model. Based on the assumption that the ratio of tide level and water depth is a small quantity, the nonlinear problems (1-1)-(1-7) become the "sum" of a series of linear problems, which can describe the astronomical-tide waves and shallow-water sub-tide waves of various orders and the tide-induced Euler residual current, and since each problem is linear, based on the principle of linear superposition, introducing the harmonic factor of time eliminates the time variable and turns it into a (dingjie) problem obeyed by any specified sub-tide wave (including the tide-induced Euler residual current) as follows[11]:

$$\frac{\partial u}{\partial x} + \frac{\partial v}{\partial y} + \frac{\partial w}{\partial z} = 0 \quad (1-8)$$

$$\begin{aligned}\frac{\partial}{\partial z} \left( v \frac{\partial u}{\partial u} \right) z + i\sigma u + f v &= g \frac{\partial \zeta}{\partial x} + x_1 \\ \frac{\partial}{\partial z} \left( v \frac{\partial v}{\partial z} \right) + i\sigma v - f u &= g \frac{\partial \zeta}{\partial y} + x_2\end{aligned}\quad (1-9)$$

$$z = 0$$

$$w = -i\sigma\zeta + \bar{f}, \quad v \frac{\partial u}{\partial z} = r_1, \quad v \frac{\partial v}{\partial z} = r_2 \quad (1-10)$$

$$z = -h$$

$$u = v = w = 0 \quad (1-11)$$

In this,  $\sigma$  is the circular frequency of the sub-tide wave in question, and the constant current obtained when  $\sigma = 0$  is the tide-induced Euler residual current,  $x_1$ ,  $x_2$ ,  $\bar{f}$ ,  $r_1$ , and  $r_2$  are limits of current velocity and tide level of lower-value sub-tides of known functions, particularly when  $x_1$  and  $x_2$  are tide-induced forces or zero and  $\bar{f} = r_1 = r_2 = 0$ . What is obtained is the solution to the tide waves of astronomical origin.

On the basis of a simplest model of the eddy viscosity coefficient  $v = v(x, y)$ , the numerical values of (1-8)-(1-11) were used to simulate the  $M_2$ ,  $S_2$ , and  $M_4$ ,  $MS_4$  sub-tides of Bohai Sea[12]. However, the assumption of this eddy viscosity coefficient is a major weakness in the physics of this model, because for shallow-sea problems, since the sea bottom has a dampening effect on turbulence, therefore,  $v$  should especially be a function of the vertical coordinate  $z$ . Feng Shizuo and Sun Wenxin (1984) made an improvement in this experimental graph, but unfortunately, in their model, the eddy viscosity coefficient  $v$  in the zero value model is still not a function of  $z$ [13].

Qin Cenghao [4440 2582 3493] and Feng Shizuo (1975) proposed an ultra-shallow water storm surge model[14] in which the zero model is a quasi-equilibrium motion, a first-order model with addition of an inertial effect correction, and if in (1-1)-(1-7) we let  $\zeta' = \bar{\zeta} = 0$ , we can obtain the basic equation group of this model as follows:

$$\frac{\partial u}{\partial x} + \frac{\partial v}{\partial y} + \frac{\partial w}{\partial z} = 0 \quad (1-12)$$

$$\begin{aligned}\frac{\partial}{\partial z} \left( v \frac{\partial u}{\partial z} \right) + f v &= g \frac{\partial \zeta}{\partial x} + x_1 \\ \frac{\partial}{\partial z} \left( v \frac{\partial v}{\partial z} \right) - f u &= g \frac{\partial \zeta}{\partial y} + x_2\end{aligned}\quad (1-13)$$

$$z = 0$$

$$w = \frac{\partial \zeta}{\partial t} + \bar{f}, \quad v \frac{\partial u}{\partial z} = T_1, \quad v \frac{\partial v}{\partial z} = T_2 \quad (1-14)$$

$$z = -h$$

$$u = v = w = 0 \quad (1-15)$$

In this, if we let  $x_1 = x_2 = \phi = 0$ ,  $T_1 = \frac{T_{11}}{\rho}$ ,  $T_2 = \frac{T_{12}}{\rho}$ , then (1-12)-(1-15) will give the zero-order model of the ultra-shallow water storm surge;  $x_1$ ,  $x_2$ ,  $\phi$ ,  $T_1$ , and  $T_2$  are known as a zero-order combined function, and in first-order models it acts as a known compulsory force.

Using  $v = v(x, y)$  eddy viscosity coefficient, Sun Wenxin, et al. (1979, 1980) used the values of (1-12)-(1-15) to simulate an ultra-shallow water storm surge Bohai Sea storm surge[15, 16]. However, because they used a  $v = v(x, y)$  eddy viscosity coefficient which is unrelated to  $z$ , the ultra-shallow storm surge was also the greatest weak point in the physical hypothesis. Feng Shizuo and Shi Ping [2457 1627] (1980) provided an improved model[17] and the eddy viscosity coefficient in this model can be a physically acceptable arbitrary-depth function, and they discussed the clear impact of the variable eddy viscosity coefficient on the storm surge. However, since the zero-order approximation of this model does not take into account the Keshi effect, it is only suited to small shallow-water bays such as Bohai Bay and Laizhou Bay. Subsequently, Sun Yinglan [1327 5391 5695] (1984)[18], Sun Wenxin, and Feng Shizuo (1983)[19] on the basis of water depth in this sea area, combined the two models discussed above, and carried out numerical calculations of the combined type and the nesting type. In addition, Wu Dexing [0702 1795 5281] (1983)[20] and Sun Wenxin separately used models of  $v$ 's secondary cross-section and primary cross-section to carry out numerical calculations of the zero-order model of an ultra-shallow water storm surge.

If we wish to calculate the residual current, then in terms of principles, after finding the current velocity using (1-1)-(1-7), we can average this current velocity in one tide cycle or over several tide cycles and the remaining constant current is the Euler residual current--this method corresponds to the method described above of obtaining the residual current by averaging the measured current velocity in a tide cycle. In fact, it corresponds to the two-dimensional space situation of the (1-1)-(1-6) whole-current equation which has already been done this way[22, 23], but there is another method which can obtain the Euler residual current: treating the variables in (1-1)-(1-7) as the sum of the tide current variable and the residual current variable (the tide current variable with time makes the tide cycle vary, and the residual current variable is the constant current). In carrying out time averaging on one or many tide cycles in (1-1)-(1-7), one obtains a satisfactory residual-current equation group. This method was first proposed by Nihowl and Ronday (1975)[24]; N. Heaps (1978)[7] provided a systematic discussion; Feng Shizuo, Xi Panggen [1153 4149 2704], and Zhang Shuzhen [1728 3219 3791] (1984) extended it to the three-dimensional (even including baroclinic) residual current situation as follows[25]:

$$\frac{\partial u}{\partial x} + \frac{\partial v}{\partial y} + \frac{\partial w}{\partial z} = 0 \quad (1-16)$$

$$\begin{aligned} \frac{\partial}{\partial z} \left( v \frac{\partial u}{\partial z} \right) + fu &= g \frac{\partial \zeta}{\partial x} + \Phi_1 \\ \frac{\partial}{\partial z} \left( v \frac{\partial v}{\partial z} \right) - fv &= g \frac{\partial \zeta}{\partial y} + \Phi_2 \end{aligned} \quad (1-17)$$

$$z = 0$$

$$w = \bar{H}, \quad r \frac{\partial u}{\partial z} = \epsilon_1, \quad r \frac{\partial v}{\partial z} = \epsilon_2 \quad (1-18)$$

$$z = -h$$

$$u = v = w = 0 \quad (1-19)$$

In which  $\epsilon_1, \epsilon_2$  are the sum of wind stress and tide stress [1, 4],  $\phi_1$  and  $\phi_2$  include sea surface air pressure and the nonlinear action of the tide variable is the nonlinear action of the tide variable, and these are the known "compulsory force" functions [25].

We do not take into account the fact that when there is a nonlinear coupling of tide variables, (1-16)-(1-19) degenerate into a permanent problem of wind sea currents, and when the role of wind stress and sea surface air pressure is not considered, the problem degenerates into a problem of a tide-induced Euler residual current.

Just as the case with shallow-sea tides and storm surges, residual-current and shallow-sea wind sea current similarly should take into consideration a  $v = v(x, y, z)$  variable eddy viscosity coefficient. Thus, in the research and discussion of the above several problems, establishing an eddy viscosity coefficient  $v$  model on the  $f$ -plane is an ideal model. In fact, Feng Shizuo (1982)[1] (1985)[26] already proposed such a shallow-sea fluid-dynamic variable eddy viscosity coefficient model, but in his article it required the solution of a proper value question which made the solution too troublesome. In this paper we use the current velocity splitting model to establish a physically relatively clear-cut and in numerical calculations a relatively simple shallow-sea fluid-dynamic model which contains a variable eddy viscosity coefficient--suited to the shallow sea tide problems (1-8)-(1-11), suited to the ultra-shallow water storm surge problems (1-12)-(1-15), and also suited to the residual-current and shallow-sea permanent wind sea current problems (1-16)-(1-19).

## II. Velocity Splitting Model

Groen and Groves[21] analyzed the various effects of the storm surge and when Sun Wenxin\* studied the ultra-shallow water storm surge and the shallow-sea growth process motion in theory, he also carried out velocity splitting. Actually, the velocity splitting method can also be used for a relatively broad class of shallow-sea motion problems.

We reduce problems (1-8)-(1-11) describing shallow-sea tides, problems (1-12)-(1-15) describing ultra-shallow water storm surges, and problems (1-16)-(1-19) describing the residual-current and shallow-sea permanent wind current to a (dingjie) problem unified in form as follows:

\*Sun Wenxin has not yet published his paper, which is a preliminary exploration of the shallow-sea motion process.

$$\frac{\partial u}{\partial x} + \frac{\partial v}{\partial y} + \frac{\partial w}{\partial z} = 0 \quad (2-1)$$

$$\begin{aligned} \frac{\partial}{\partial z} \left( v \frac{\partial u}{\partial z} \right) + i\sigma u + fv &= g \frac{\partial \zeta}{\partial x} + gY_1 \\ \frac{\partial}{\partial z} \left( v \frac{\partial v}{\partial z} \right) + i\sigma v - fu &= g \frac{\partial \zeta}{\partial y} + gY_2, \end{aligned} \quad (2-2)$$

$$z = 0$$

$$w = \frac{\partial \zeta}{\partial t} - i\sigma \zeta + Z, \quad v \frac{\partial u}{\partial z} = X_1, \quad v \frac{\partial v}{\partial z} = X_2 \quad (2-3)$$

$$z = -h$$

$$u = v = w = 0 \quad (2-4)$$

in which:

(1) For the shallow-sea tide (dingjie) problem:  $\frac{\partial \zeta}{\partial t} = 0, Y_1 = X_1, Y_2 = \frac{X_2}{g}$ ,

$Z = \bar{f}, X_1 = r_1, X_2 = r_2, (u, v, w, \zeta)$  is the solution of the sub-tide wave of frequency  $\sigma$  in the  $j$ th ( $j = 0, 1, 2\dots$ ) order sub-tide wave;  $x_1, x_2$  are when the tide-induced force equals zero or does not equal zero, when  $f = r_1 = r_2 = 0$  is the astronomical tide wave, that is, the solution of the zero order sub-tide wave, and when  $\sigma = 0$  it is the solution of the Euler residual current.

(2) For the ultra-shallow water storm surge (dingjie) problem:

$\sigma = 0, Y_1 = \frac{X_1}{g}, Y_2 = \frac{X_2}{g}, Z = \theta, X_1 = T_1, X_2 = T_2 (u, v, w, \zeta)$  is the solution of

this (dingjie) problem, corresponding to  $(x_1 = x_2 = \theta = 0) T_1 = \frac{\tau_{ss}}{\rho}, T_2 = \frac{\tau_{ss}}{\rho}$ , zero order solution and a one-value perturbation solution when  $x_1, x_2, \theta, T_1$  and  $T_2$  are not zero.

(3) For the Euler residual-current (dingjie) problem:

$\sigma = 0, \frac{\partial \zeta}{\partial t} = 0, Y_2 = \frac{\Phi_2}{g}, Y_1 = \frac{\Phi_1}{g}, Z = \bar{H}, X_1 = \varepsilon_1, X_2 = \varepsilon_2$  and  $(u, v, w, \zeta)$

are residual-current variable solutions. In which  $(u, v)$  are residual currents when nonlinear coupling  $(\bar{H} \neq 0)$  between tide current variables is

not taken into account,  $\varepsilon_1 = \frac{\tau_{ss}}{\rho}, \varepsilon_2 = \frac{\tau_{ss}}{\rho} \Phi_1, \Phi_2$  are sea surface air pressure

which when they are or are not zero may be the permanent problems of shallow-sea wind current. When the action of sea surface wind stress and sea surface air pressure ( $\tau_{ss} = \tau_s = 0, \zeta = 0$ ) are ignored it is the solution of the tide-induced Euler residual current.

The continuous integral equation (2-1) from sea surface to sea bottom is substituted in the first equation in equation (2-3) and using (2-4) we have a continuous equation of whole-current form:

$$\frac{\partial \zeta}{\partial t} + \frac{\partial U}{\partial x} + \frac{\partial V}{\partial y} - i\sigma\zeta = -Z \quad (2-5)$$

in which the whole current

$$U = \int_{-h}^0 u dz, \quad V = \int_{-h}^0 v dz \quad (2-6)$$

let:

$$x' = x, \quad y' = y, \quad \xi = \frac{z}{h}, \quad t' = t \quad (2-7)$$

Substitute the coordinate conversion (2-7) in the last two equations (2-4) of the motion equation (2-2) and the boundary condition (2-3) and we have:

$$\begin{aligned} \frac{\partial}{\partial \xi} \left( v \frac{\partial u}{\partial \xi} \right) + ih^2 \sigma u + h^2 f v &= gh^2 \frac{\partial \zeta}{\partial x} + gh^2 Y_1 \\ \frac{\partial}{\partial \xi} \left( v \frac{\partial v}{\partial \xi} \right) + ih^2 \sigma v - h^2 f u &= gh^2 \frac{\partial \zeta}{\partial y} + gh^2 Y_2 \end{aligned} \quad (2-8)$$

$$\xi = 0$$

$$v \frac{\partial u}{\partial \xi} = h X_1, \quad v \frac{\partial v}{\partial \xi} = h X_2 \quad (2-9)$$

$$\xi = -1$$

$$u = v = 0 \quad (2-10)$$

For convenience,  $x'$ ,  $y'$ , and  $t'$  are also expressed as  $x$ ,  $y$ , and  $t$ . Clearly the continuous equation (2-5) after conversion of (2-7) maintains its form and only (2-6) changes to

$$U = h \int_{-1}^0 u d\xi, \quad V = h \int_{-1}^0 v d\xi \quad (2-11)$$

The eddy viscosity coefficient  $v$  is the motion function, that is, it should be the flow field distribution function, and to simplify things, suppose

$$v = v_0(x, y, t) F(\xi) \quad (2-12)$$

In which  $v_0$  and  $F(\xi)$  are functions of any form permitted in physics.  $F(\xi)$  is defined as the non-dimensional vertical cross-section of  $v$ , the  $v_0$  dimension and the  $v'$  dimension are the same, the eddy viscosity coefficient model expressed by (2-12) does not clearly contain velocity and its various order derivatives, and the influence of the flow distribution on the eddy viscosity

coefficient is implicit in the space-time distribution of  $\mathbf{v}$ . Thus, we call (2-12) the linearized model of eddy viscosity coefficient model  $\mathbf{v}$ , and since  $v_0$  and  $F(\xi)$  are physically acceptable arbitrary functions, in terms of the scope of linearized models of eddy viscosity coefficient, the  $\mathbf{v}$  model expressed by (2-12) is a universal linear model and then the entire problem is linearized.

We multiply the last equation in (2-8) and (2-9) by the imaginary unit  $i$ , then add them to the earlier equations, and introduce the complex velocity

$$\mathbf{q} = \mathbf{u} + i\mathbf{v} \quad (2-13)$$

Then substitute this in equation (2-12), and we obtain the boundary value problem of a complex velocity which should obey the ordinary differential equation as follows:

$$v_0 \frac{\partial}{\partial \xi} \left[ F(\xi) \frac{\partial \mathbf{q}}{\partial \xi} \right] + i(\sigma - f) h^2 \mathbf{q} = gh^2 \Gamma + gh^2 Y \quad (2-14)$$

$$\xi = 0$$

$$v_0 F(\xi) \frac{\partial \mathbf{q}}{\partial \xi} = h X \quad (2-15)$$

$$\xi = -1$$

$$\mathbf{q} = 0 \quad (2-16)$$

in which,  $\Gamma = \Gamma_1 + i\Gamma_2$ ,  $\Gamma_1 = \frac{\partial \xi}{\partial x}$ ,  $\Gamma_2 = \frac{\partial \xi}{\partial y}$ ,  $Y = Y_1 + iY_2$ ,  $X = X_1 + iX_2$

Because this problem is a linear problem, on the basis of the principle of linear superposition, we can divide the current velocity into the sum of three current velocities:

$$\mathbf{q} = \mathbf{q}_r + \mathbf{q}_x + \mathbf{q}_y \quad (2-17)$$

They satisfy, respectively, the following problems:

$$\left. \begin{aligned} & v_0 \frac{\partial}{\partial \xi} \left[ F(\xi) \frac{\partial \mathbf{q}_r}{\partial \xi} \right] + i(\sigma - f) h^2 \mathbf{q}_r = gh^2 \Gamma \\ & \xi = 0, \quad v_0 F(\xi) \frac{\partial \mathbf{q}_r}{\partial \xi} = 0 \\ & \xi = -1, \quad \mathbf{q}_r = 0 \end{aligned} \right\} \quad (2-18)$$

$$\left. \begin{aligned} & v_0 \frac{\partial}{\partial \xi} \left[ F(\xi) \frac{\partial \mathbf{q}_x}{\partial \xi} \right] + i(\sigma - f) h^2 \mathbf{q}_x = 0 \\ & \xi = 0, \quad v_0 F(\xi) \frac{\partial \mathbf{q}_x}{\partial \xi} = h X \\ & \xi = -1, \quad \mathbf{q}_x = 0 \end{aligned} \right\} \quad (2-19)$$

$$\left. \begin{aligned} v_0 \frac{\partial}{\partial \xi} \left[ F(\xi) - \frac{\partial q_y}{\partial \xi} \right] + i(\sigma - f) h^2 q_y &= gh^2 Y \\ \xi = 0 \quad v_0 F(\xi) \frac{\partial q_y}{\partial \xi} &= 0 \\ \xi = -1 \quad q_y &= 0 \end{aligned} \right\} \quad (2-20)$$

(2-18) described the current  $q_y$  induced by water level gradient and termed it "gradient current"; (2-19) described the flow  $q_x$  caused by sea surface "shear stress  $X$ " and termed it "shear current" and when  $\sigma = 0$  and  $X = \tau_{ax} + i\tau_{ay}$ , it causes the classic shallow-sea wind current problem; and (2-20) described the flow  $q_y$  induced by a mass force  $Y$  which is similar to the gravitational tide force and termed it "gravitational current." When  $Y$  is the gravitational tide force it causes the classic independent-tide problem.

Let:

$$\left. \begin{aligned} q_x &= \frac{gh^2}{v_0} \Gamma S(\xi) \\ q_x &= \frac{h}{v_0} X \bar{W}(\xi) \\ q_x &= \frac{gh^2}{v_0} G(\xi) \end{aligned} \right\} \quad (2-21)$$

Substituting (2-21) in (2-18), (2-19), and (2-20), respectively, we obtain the non-dimensional gradient current cross-section  $S(\xi)$ , non-dimensional stress current cross-section  $W(\xi)$ , and the gravitational current's non-dimensional cross-section  $G(\xi)$  satisfying the ordinary differential equation's (dingjie) problem as follows:

$$\left. \begin{aligned} \frac{\partial}{\partial \xi} \left[ F(\xi) - \frac{\partial S(\xi)}{\partial \xi} \right] + i \mathcal{D}_L S(\xi) &= 1 \\ \xi = 0 \quad \frac{\partial S(\xi)}{\partial \xi} &= 0 \\ \xi = -1 \quad S(\xi) &= 0 \end{aligned} \right\} \quad (2-22)$$

$$\left. \begin{aligned} \frac{\partial}{\partial \xi} \left[ F(\xi) - \frac{\partial \bar{W}(\xi)}{\partial \xi} \right] + i \mathcal{D}_L \bar{W}(\xi) &= 0 \\ \xi = 0 \quad \mu(\xi) \frac{\partial \bar{W}(\xi)}{\partial \xi} &= 1 \\ \xi = -1 \quad \bar{W}(\xi) &= 0 \end{aligned} \right\} \quad (2-23)$$

$$\left. \begin{aligned} \frac{\partial}{\partial \xi} \left[ F(\xi) \right] \frac{\partial G(\xi)}{\partial \xi} + i \mathcal{D}_L G(\xi) &= Y(\xi) \\ \xi = 0 \quad \frac{\partial G(\xi)}{\partial \xi} &= 0 \\ \xi = -1 \quad G(\xi) &= 0 \end{aligned} \right\} \quad (2-24)$$

in which the non-dimensional parameter  $\Phi_L$

$$\Phi_L = \frac{\sigma - f}{v_0/h^2} \quad (2-25)$$

Clearly, if  $\sigma = 0$ , and takes an absolute value, then  $\Phi_L$  is the reciprocal of the Ekman number[3]. Under ordinary circumstances,  $v_0$  and  $h^2$  are functions of  $(x, y, t)$  and  $(x, y)$ , respectively. Therefore,  $\Phi_L$  is a partial parameter. From (2-22) and (2-23) it can be seen that the gradient current cross-section  $S = S(\xi, F(\xi), \Phi_L)$ , stress current cross-section

$\bar{W} = \bar{W}(\xi, F(\xi), \Phi_L)$ . From (2-24) it can be seen that gravitational current cross-section  $G = G(\xi, F(\xi), \Phi_L, Y)$ . Through parameter  $\Phi_L$  and external force  $Y(x, Y, t)$  it acts as a parameter implicit in the non-dimensional current cross-section. Generally speaking, if we are given the eddy viscosity coefficient  $v_0$  and  $F(\xi)$ , then under specific conditions of  $F(\xi)$ , it can provide the analytical solution of (2-22)-(2-24). Furthermore, using numerical integration is also unprincipled and difficult. Summarizing the above, we have velocity  $q$

$$q = \frac{gh^2}{v_0} \Gamma S(\xi) + \frac{h}{v_0} X W(\xi) + \frac{gh^2}{v_0} G(\xi) \quad (2-26)$$

To obtain velocity  $q$ , we must use (2-22)-(2-24) to find  $S(\xi)$ ,  $\bar{W}(\xi)$ , and  $G(\xi)$ , respectively, and substitute them in (2-26), and obtain by integration the expression of the whole current, substitute it in the continuous equation and solve for  $\xi$ , then find  $\Gamma$  and substitute it in (2-26), and finally obtain the correct (dingjie) of velocity.

Integrating (2-26), we obtain the complex whole current  $Q = U + iV$ , i.e.,

$$Q = \frac{gh^3}{v_0} I_3 \Gamma + \frac{h^2}{v_0} I_2 X + \frac{gh^3}{v_0} I_1 \quad (2-27)$$

in which

$$I_3 = \int_{-1}^0 S(\xi) d\xi, \quad I_2 = \int_{-1}^0 \bar{W}(\xi) d\xi, \quad I_1 = \int_{-1}^0 G(\xi) d\xi \quad (2-28)$$

Substituting (2-27) in the continuous equation (2-5) and introducing the complex field quantity  $A = A_R + A_I$ , then we have the partial differential equation which satisfies water level  $\xi$  as follows:

$$\frac{\partial \zeta}{\partial t} + A_R \left( \frac{\partial^2 \zeta}{\partial x^2} + \frac{\partial^2 \zeta}{\partial y^2} \right) + \left( \frac{\partial A_R}{\partial x} + \frac{\partial A_I}{\partial y} \right) \frac{\partial \zeta}{\partial x} - \left( \frac{\partial A_R}{\partial y} - \frac{\partial A_I}{\partial x} \right) \frac{\partial \zeta}{\partial y} - i\omega \zeta = \mathcal{F} - Z \quad (2-29)$$

in which

$$A = \frac{gh^2}{v_0} I_2$$

$$\mathcal{F} = - \left\{ \frac{\partial}{\partial x} \left[ \frac{h^2}{v_0} (X I_x)_x + \frac{gh^2}{v_0} (I_x)_x \right] + \frac{\partial}{\partial y} \left[ \frac{h^2}{v_0} (X I_y)_y + \frac{gh^2}{v_0} (I_y)_y \right] \right\}$$

To solve water level  $\zeta(x, y, t)$ , in addition to equation (2-29), we should also provide suitable flank boundary conditions, shore interface whole current conditions, and water interface conditions, and these will be different depending on different shallow-water dynamics problems.

### III. Linear Bottom Friction Laws

The velocity splitting model can also help us study the problem of bottom friction. All the velocity splitting models described above which can be applied can derive the precise expression of bottom friction.

For this, for equation (2-14) from sea bottom to sea surface integration,

$$\text{introduce into the bottom friction expression: } \frac{r_b}{\rho} = \frac{r_{b0} + r_{b1}}{\rho} = \frac{1}{h} \cdot v_0 F (-1) \left( \frac{\partial \zeta}{\partial t} \right)_{-1}$$

and if we then substitute (2-11) in the form of parallel whole flow, at the same time taking into account sea surface and sea bottom boundary condition (2-15) and (2-16), then we have

$$hX - h \frac{r_b}{\rho} + i(\alpha - f)hQ = gh^2 \Gamma + gh \int_{-1}^0 Y(\xi) d\xi \quad (3-1)$$

Using (2-17) and (3-1) to combine and eliminate  $\Gamma$ , then we have the bottom friction expression:

$$\frac{r_b}{\rho} = -\alpha X + \beta Q + \delta \Gamma \quad (3-2)$$

in which

$$\alpha = - \left( 1 + \frac{I_x}{I_y} \right)$$

$$\beta = \frac{v_0}{h^2} \left[ i \mathcal{F}_L - \frac{1}{I_y} \right]$$

$$\delta = gh \left[ \frac{I_x}{I_y} - \int_{-1}^0 Y(\xi) d\xi \right]$$

In a section above we mentioned that for the shallow-water hydrodynamic two-dimensional equation group of a shallow-water flow depth average model, we must suppose an experience relationship of bottom friction and whole-current functions, generally the primary assumption law and secondary experience law are adopted as follows [3]:

$$\frac{\tau_x}{\rho} = -\sigma \frac{\tau_x}{\rho} + \sigma Q \quad (3-3)$$

$$\frac{\tau_x}{\rho} = -\sigma \frac{\tau_x}{\rho} + \frac{\sigma |Q| Q}{(h + \zeta)^2} \quad (3-4)$$

in which  $\sigma$ ,  $\beta$ , and  $\sigma$  are experience coefficients.

First of all, comparing equation (3-2) to (3-3) and (3-4), it is not difficult to discover that the bottom friction law we induced is linear and not secondary, and in line with what was said above, the eddy viscosity coefficient is a linearized model. Thus, we can read the following conclusion: a linearized eddy viscosity coefficient model corresponds to a linear bottom friction law, and the characteristics of eddy viscosity coefficient  $\sigma$  cross-section are already contained in the various coefficients of bottom friction law (3-2).

Next, expression (3-2) compared with experience law (3-3) has an extra term  $\sigma$ . The production of this term is driven by equal mass forces of gravitational force or nonlinear low-order term nonlinear coupling. Thus, what (3-2) represents is a broadly defined nonlinear bottom friction law, and from this it can be seen that (3-3) experience law is not a perfect form, even if it corresponds to the linearized eddy viscosity coefficient model.

Finally, even if we do not take into account the terms in equation (3-2), there is still an important difference between (3-2) and (3-3), which is that  $\alpha$  and  $\beta$  (of course there is also  $\sigma$ ) in equation (3-2) are complex coefficients, i.e.,  $\alpha = \alpha_R + i\alpha_I$ ,  $\beta = \beta_R + i\beta_I$  ( $\sigma = \sigma_R + i\sigma_I$ ), but the  $\alpha$  and  $\beta$  in (3-3) are real numbers. In fact, the  $\alpha$  and  $\beta$  in (3-3) are only the  $\alpha_R$  and  $\beta_R$  in (3-2). This further indicates the imperfection of (3-3) experience law. This is because virtual  $\alpha_I$  and  $\beta_I$  of  $\alpha$  and  $\beta$  in the theoretical bottom friction law indicate the function of stress  $\beta$  lateral component and the correction of the Kashi force effect, respectively. To explain this point, we need only split (3-2) into real and virtual components:

$$\left. \begin{aligned} \frac{\tau_{bx}}{\rho} &= -\alpha_R X_1 + \beta_R U + \alpha_I X_1 - \beta_I V + \sigma_R \\ \frac{\tau_{by}}{\rho} &= -\alpha_R X_2 + \beta_R V - \alpha_I X_2 + \beta_I U + \sigma_I \end{aligned} \right\} \quad (3-5)$$

The two terms in front of the signs and in equation (3-5) express the experience law (3-3), the third term ( $\beta_R U$  and  $\alpha_I X_1$ ) is the role of lateral and stress components, and the fourth term ( $-\beta_I V$  and  $\beta_I U$ ) is the corrections of the (Kashi) force effect.

#### IV. Conclusion

This paper proposes for shallow water fluid dynamic model containing a varying eddy viscosity coefficient. Based on velocity splitting principles, its main characteristic is that the eddy viscosity coefficient of this model

can be a function of the depth coordinate in any physically acceptable form, and this model can be applied to shallow-sea tide waves, ultra-shallow water storm surges, permanent wind currents, and the Euler residual current.

Based on this model, we derived a broadly defined bottom friction linear law which can be viewed as a theoretical deduction of the experience law of the linear function made up of the generally adopted bottom friction and whole current, and can also be seen as its extension. Furthermore, from this we reach the conclusion that a bottom friction and whole-current linear law corresponds to the linearized model of an eddy viscosity coefficient.

Clearly, to indicate the usability of this model we should carry out numerical experiments on related problems in a specific sea area and this task will be given in another paper<sup>[27]</sup>.

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PHYSICAL SCIENCES

WINTER CURRENT PATTERNS OF EAST CHINA SEA, YELLOW SEA FROM REMOTE SENSING DATA

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[Article by Peng Chengji [1756 2110 1015], Department of Marine Physics: "Winter Current Pattern of the East China Sea and Yellow Sea From Satellite Infrared Remote-Sensing Imaging"; paper received 15 December 1984; first paragraph is source-supplied English abstract]

[Text] Abstract: Based on the sea surface temperature from AVHRR of satellite NOAA-6, the specific paths of the Yellow Sea warm current and the coastal currents in this region are obtained in this paper. A small branch of the Yellow Sea warm current is found around 34.5N, 122.5E, moving towards the northwest. Also it was found in the south of the East China Sea that a warm water mass comes from the Kuroshio current and moves towards the north. It may cause the Subei coastal current and a part of the fresh water of the Changjiang River to move to the off-lying sea.

For a long time people have carried out a great number of observations and studies on the marine currents in the Yellow Sea and East China Sea region, so we have some basic understanding of them. Of course, due to the complexity of the oceans, this understanding, which is based on traditional methods of observation, still cannot be said to be complete and detailed. On this foundation and on the basis of satellite remote-sensing infrared remote-sensing images, this paper gives a more detailed description of the marine currents in this area.

Already in 1931, on the basis of many years of average temperature and saline materials, the Japanese oceanologist Uda Michitaka provided the distribution of marine currents in the Yellow and East China Seas (Figure 1) and clearly suggested the existence of a Yellow Sea warm current.<sup>[6]</sup>

Uda's conclusions were widely accepted and for a long time served as basic knowledge of the marine current system in this area. Except for wind currents, in this area primarily north to south coastal currents and warm-water currents have been injected with high temperature-high salinity water from off-lying seas supported by ocean currents (Kuroshio). The warm-water currents are in a direction opposite that of the seasonal winter winds, which as Guan Bingxian [4619 4426 6343] (1962) pointed out, is a jet-like

current. The primary current is along a water-tongue axis.<sup>[1]</sup> We can clearly see this water tongue distribution from satellite remote-sensing sea surface temperature field images and on the basis of the distribution of this water tongue can deduce the distribution of the actual current. From the results we obtained, in addition to seeing that there are some differences between the specific path of the Yellow Sea warm current and Uda's results, we can also see some new features which have not heretofore been discovered. It should be pointed out here that although what was obtained from satellite remote sensing was only the sea surface temperature field, since the vertical mixing in this area in the winter is severe, the sea water temperature and salinity parameters in the better part of the sea area exhibit a vertically homogeneous state.<sup>[1]</sup> Therefore, the hydrological state of the sea surface to a considerable degree also reflects the state below the sea surface.



Figure 1. Distribution of Winter Surface Currents in Yellow Sea and East China Sea (Uda, 1931)

We studied the great quantity of AVHRR digital images of the NOAA series satellites for the period 1979-81. They all displayed a similar marine current structure. Here we will cite only two examples. Figure 2 is a color image, after image processing, of a NOAA-6 AVHRR4 waveband (10.5  $\mu\text{m}$ -11.5  $\mu\text{m}$ ) image from 14 March 1980. For the processing method, see [2]. The dark curved lines in the picture are sea bottom depth contours (unit: fathoms), the temperature values represented by the various colors are given below the figure (unit:  $^{\circ}\text{C}$ ), and the white areas are areas of clouds eliminated after image processing.

Figure 3 is the post-image processing<sup>[2]</sup> black and white image from the NOAA-6 AVHRR waveband (10.5  $\mu\text{m}$ -11.5  $\mu\text{m}$ ) image on 10 February 1981, and the sea surface temperature of areas corresponding to the highly grey areas is high; Figure 4 is the result of converting this image to color, and at the same time the image was provided with latitude and longitude and sea bottom depth contours (red curved lines, unit: fathoms).



Figure 2. NOAA-6 Satellite AVHRR-4 Image of Sea Surface Temperature Field on 14 March 1980.



Figure 3. Black and white NOAA-6 Satellite WIR-1 Image of Sea Surface Temperature Field on 10 February 1981. (Grey corresponds to high temperature.)



**Figure 4. Color Photograph of Figure 3 After Color Processing and Figure Superpositioning Processing (latitude, longitude, and sea bottom depth contours shown; unit: fathoms)**

From Figures 2 and 3 it is not hard to make a preliminary description of the marine currents in this area. We can see the following new features which were previously unknown:

1. The Yellow Sea warm current system which is a branch of the Ma [7456] warm current enters the Yellow Sea in a northwesterly direction from south of Jizhou Island. Its axis generally follows between the 30-fathom (about 55 meters) and 40-fathom (about 73 meters) depth contours, when it reaches the vicinity of  $34.5^{\circ}\text{N}$ ,  $122.5^{\circ}\text{E}$ , it immediately breaks off toward the north along the 30-fathom contour, and after reaching the northern Yellow Sea it again turns to the west and enters the Bohai Sea. At  $34.5^{\circ}\text{N}$ ,  $122.5^{\circ}\text{E}$ , there is still a partial warm current which out of inertia continues to flow in a northwesterly direction toward the coast on the southern part of Shandong where it mixes with the coastal waters there. According to survey vessel materials, this small branch of the Yellow Sea warm current has not yet been observed.
2. After flowing past Shantou (the point of Shandong peninsula), the coastal current (low temperature-low salinity water), which flows from the southern part of the Bohai Sea, for the most part flows to the south away from the shore (and not southwesterly along the seacoast), and in the vicinity of approximately  $35^{\circ}\text{N}$ ,  $121.5^{\circ}\text{E}$ , it mixes with the warm water of part of the Yellow Sea warm current.
3. In the vicinity of approximately  $30^{\circ}\text{N}$ ,  $121^{\circ}\text{E}$  in the southern part of the East China Sea there is general warm water from south to north to near the mouth of the Changjiang River. According to meteorological records, from

2 February to 10 February the wind direction in this area is northerly or northwesterly (actually, northerly or northwesterly winds prevail in this area throughout the winter)[1], clearly this warm-water current which is opposite the wind is not wind-induced (thus in other seasons it may also exist). Note that the sea bottom topography here at the 30-fathom contour bulges toward the north and this may explain the tendency of part of the Taiwan warm current in Kuroshio to intrude toward the north. It is very possible that this warm water forces some of the Changjiang River's diluted water to flow north and after merging with the Subei coastal current toward the south to head eastward, and then toward the southeast when reaching the vicinity of 32°N, 125°E, to mix with the warm water coming from Kuroshio. This also explains the fact that the silt carried by the Subei coastal current does not reach the mouth of the Changjiang River but is directly transported to the outer sea and part of the silt carried into the sea by the Changjiang River may be deposited in the coastal seas to the north of the mouth of the Changjiang River. This agrees with the conclusions of the research of Yun Caixing [1926 2088 5281] on the dispersion of Changjiang River silt entering the sea.[3]

Figure 5 (photograph) shows the distribution of depth contours and currents of the East China and Yellow Seas drawn on the Figure 2 on the basis of the above analysis. The red arrows indicate warm currents (high temperature-high salinity) and the blue arrows indicate coastal currents (low temperature-low salinity).



Figure 5. Figure 3 With Depth Contour Overlay Showing Relationship of Currents and Sea Bottom Topography

Figure 6 shows the distribution of currents in the entire sea area. Compared with Figure 1, the differences are clear.



Figure 6. Winter Current Distribution of Yellow Sea and East China Sea

Key:

1. Yellow Sea warm current	3. Coastal current
2. Warm-water current	

The above are analyses carried out on currents on the basis of sea surface temperature distribution, but they also require obtaining confirmation from other areas, especially the results of actual current observations.

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## CODING SYSTEMS FOR COMPUTER PROCESSING OF CHINESE

Beijing DIANZI XUEBAO [ACTA ELECTRONICA SINICA] in Chinese Vol 14, No 4, Jul 86 pp 108-113

[Article by Zhao Pozhang [6392 3789 3864], Beijing Institute of Information and Control: "On the Design of Internal Processing Code for Chinese Character Information Processing Systems"]

[Text] Abstract: This paper first derives a coding series for Chinese-character information processing systems (CCIPS) based on current computer coding systems, then gives a detailed discussion of internal processing code series for CCIPS and their methods of design. It also briefly describes the problem of internal processing code for systems handling the text of national minorities.

### I. Preface

The difference in nature between the computer processing of Chinese textual information on the one hand and Western text information on the other lies only in a difference in the information coding systems. The characters of Chinese texts, and especially Han Chinese characters, not only number 50,000 and more, but their code length is also much longer than the Western text's alphabetic characters of which there are less than 100.

The five-layer structural model for Chinese language information processing systems as established in my paper [1] (Figure 1) divides Chinese-character information coding into the two categories of external coding and internal coding, which reflects the characteristics and difficulties that differ from Western information processing. This is because at the stages of information collection, processing, transmission, storage, and usage, it is very difficult for Chinese-character information to be implemented by one kind of code, as can Western language information, but rather it must undergo a certain transformation before it can work.

What is currently receiving academic and engineering attention these days, both in this country and abroad, is that in this CCIPS which is based on existing computers and their systems and which should be able to incorporate Western languages, what should the relation be between the coding systems for Chinese and Western languages, how should the CCIPS be set up, and what

should the relations be between the coding systems for Chinese characters and those of the more than 10 national minority languages such as Mongolian, Uygor, Tibetan, and Zhuang.

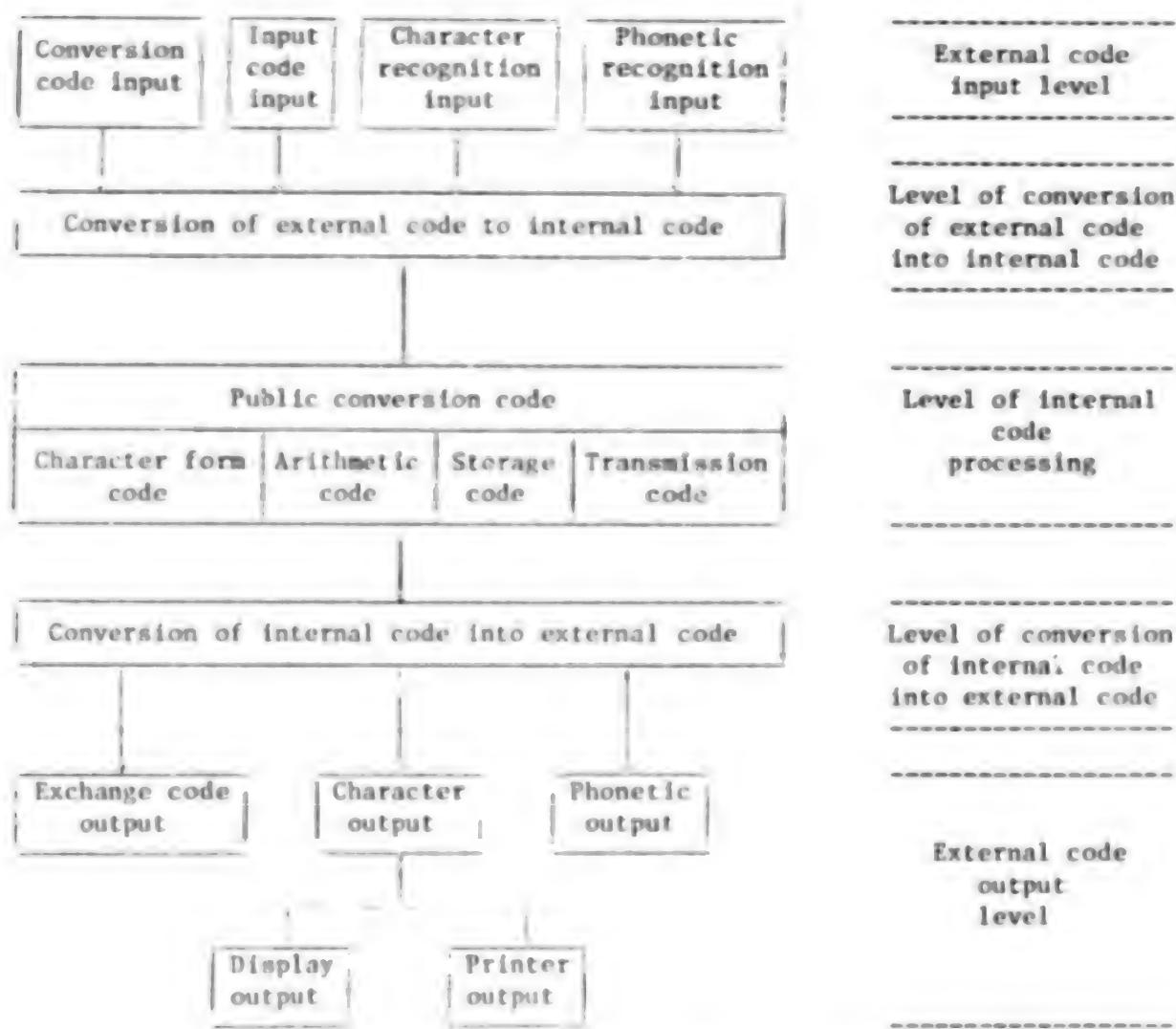


Figure 1. Five-Level Structural Model for Chinese Language Information Processing Systems

This paper emphasizes a discussion of the problem of internal coding for Chinese-character information processing systems. Regarding the processing of various minority nationality characters, this paper makes only a brief description, and those who would prefer a more detailed understanding should consult Zhao [2].

## II. Seven-Bit Coding Systems

The international standard ISO 646 "Information processing and exchange using 7-bit character sets" is one of the primary coding systems used for computer information exchange and processing. The American ASCII code and the GB1983 code [3] of this country are forms consistent with that.

The national standard GB2312 "character set for information exchange using Chinese-character coding" [1] that has been formulated in accordance with our national standard GB2311 "expansive method for information processing and exchange using 7-bit coded character sets" has only 6,763 Chinese characters and 682 symbols, and several subsidiary sets have yet to be developed; in addition, a Chinese character is expressed by two 7-bit bytes, which are not distinguished internally by the computer as being different from Western languages. Therefore, these are only suitable for use in Chinese-character information exchange, but not for use in Chinese-character information processing. If the computer is to be used to process both Chinese text and that of Western languages, we must establish ways to distinguish Chinese-character coding from Western language coding, that is, an identifier must be added for Chinese characters.

### A. Two-byte Chinese-character internal processing code

The common format for 2-byte Chinese-character internal processing codes (hereafter, internal coding) is shown in Figure 2. To save on system overhead and to improve system proves (i.e. efficiency), there should be a corresponding relation between Chinese-character internal coding and the national standard exchange coding. In view of the fact that national standard exchange coding is based upon seven bits, there are four formats using two 7-bit bytes as shown in Figure 3.



Figure 3. Four Formats for 2-byte Chinese-character Internal Coding Based on a 7-bit Coding System

The "00" format has been established as the national Chinese character exchange coding, and it cannot be used directly as processing coding.

The "01" format can be used for Chinese-character internal processing code. When the system has determined that the eighth bits in a 2-byte sequence are "0" and "1", respectively, it then interprets these two codes as Chinese characters, and otherwise these are interpreted as two Western language bytes. Because the eighth bit of the first byte in a Chinese character code is "0", it is easy to generate a different meaning from that of Western language character coding, just requiring some changes in Western language editing programs. The "01" format can avoid ambiguities with Chinese character coding.

The characteristics of the "10" format are similar to those of the "01" format.

Because both eighth bits in the two bytes of the "11" format are set to "1", it is very easy to distinguish Chinese-character coding from that of Western language character coding, but the Chinese-character codes can themselves easily generate ambiguities, that is, it is possible to mistake the second byte of the first Chinese-character code and the first byte of the following Chinese-character code as a new Chinese-character code. This problem can also avoid ambiguities by changing editing routines.

Regarding computers for 7-bit coding, operating systems may not recognize the eighth bit, or will filter it, or will treat it as an error. Therefore, the operating system must be revised, together with relevant software, to allow the system to accept the eighth bit before the "01", "10", or "11" formats for Chinese character internal coding can be used. Obviously, two bytes can accommodate a basic set and two auxiliary sets.

For those systems using only the basic set of Chinese characters, to make full use of the software and hardware resources of the original computer system, the following conversion of GB2312 can be made [6]:

The eighth bit of the first character byte can be set to "1".

The second byte is represented with the 94 codes in the GB2311 8-bit code tables that are 30h 39h, 41h 5Ah, 61h 7Ah, and 80h 9Fh. Currently, the 32 codes from 80h to 9Fh have not been assigned, and they may be used for Chinese character coding. This coding structure is shown in Figure 4.

By using the Chinese character coding obtained from using this conversion, we can avoid generating various ambiguities after using ASCII coding with the 32 graphics symbols remaining that are apart from the numbers 0-9 and the 52 upper and lower case Latin alphabet letters.

There is a simple 2:1 ratio in terms of space when using 2-byte Chinese-character internal coding together with Western language characters, which has a certain convenience for display and printer output.



Figure 4. GB2312 Coding Structure (After the 3rd edition).

## B. Three-byte Chinese-character Internal Processing Code

The common format for 3-byte Chinese-character internal processing code is shown in Figure 5, and there are the following conventional forms:



Figure 5. Common Format of 3-byte Chinese-character Internal Code.

### 1. Independent 3-byte form

Each byte is one of the 94 triplets (000-111), the code space for which is

$$94 \times 94 \times 94 = 784,352$$

which is far higher than the total number of well-known Chinese characters and graphics symbols. But because the number of Chinese characters in use has not yet been resolved (only 6000 of code is completed), the same six corresponding byte code for Korean, Japanese, and others, must be needed, and efficiency is low, this method has no longer directly applied to anyone.

### 2. Three-byte internal processing code (000-111)

Treats the first byte as a Chinese-character coding identifier, then the system has encountered a little byte (000-111), the next two bytes will

be interpreted as a Chinese character, and otherwise every byte code will be interpreted as Western text.

Only one identifier may be used, or several could be used. Selection of which would differ with data to be used to be best selected during system design. For example, in the Chinese computer system seven identifiers are used in Chinese characters for internal coding. The structure is as follows.

1. first byte: only the following 16 characters may be used:

00000000

2. Second byte: may be any one of the codes ranging from the arabic numbers 0-9, to the uppercase characters A-Z, to the lowercase a-z, and the 7 graphic characters that suffice the first byte.

3. third byte: the same characters with the codes 000-07F.

The total coding space of 16384 bytes is too limited for internal coding. In

00000000-0000007F

regarding the transformation of the Chinese character internal codes into systems that accept the ASCII characters, it would be best to have it to be very careful in the selection of the identifier, so that to allow it to be mutually compatible with ASCII. The identifier may, and it should be able to develop its own Chinese character internal code with its own patent law.

Figure 181 has described several Chinese character internal codes, i.e. for example the anti-identifiers 00000000, 00000001, and the code A91. This has a certain use value in that it is used for only the 002312 Chinese character code set, it will not allow the conversion between Chinese-English languages and Chinese-Chinese internal coding.

4. Four-byte Chinese character internal coding code:

First byte	0-7F	Second byte	0-7F	Third byte	0-7F	Fourth byte	0-7F
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Figure 181. Chinese Internal Coding of Chinese-Character Internal Coding

Different computers have different restrictions regarding the same 7-bit code ASCII system. Some systems do not accept any uppercase Latin letters, while some do not accept certain graphic symbols. Typically, the Arabic numerals 0 through 9 and uppercase letters A-Z will be accepted. Therefore, characters on certain computers (e.g., DEC 10) characters can be used to

represent Chinese character coding. The coding space when using this 3-byte system is

$$36 \times 36 \times 36 = 46,656$$

in which the first byte is used for the Chinese-character indicator, and which can then constitute 4-byte Chinese-character internal coding. The selection of these indicators might be considered to be the same as that for indicators for the 3-byte Chinese-character internal coding.

It is worth noting that when 3-byte and 4-byte Chinese-character internal coding is outputting Chinese characters to a display, if that is converted to the 2-byte coding format you can maintain the space ratio of Chinese characters to Western language characters of 2:1.

When choosing Chinese-character internal coding, attention should be paid to avoiding the following conditions [7]:

1. The coding character set did not avoid literal delimiters;
2. Line-feed symbol in multi-line phrases;
3. Function call adds the right parenthesis for bracketed parameters;
4. Flag for character string data;
5. Macro call identifier;
6. Chinese-character identifier;
7. Chinese-character shape controller mark;
8. Chinese-character output format controller mark.

This is to avoid various ambiguities that could be generated by the 32 graphics symbols in ASCII code other than the Arabic numerals 0-9 and the upper- and lowercase Latin alphabet.

### III. Eight-Bit Coding Systems

The EBCDIC code is a representative 8-bit coding system, and its structure is as shown in Figure 6. It can be seen that this code can provide 190 code positions for use in Chinese-character development, among which 94 code positions have been defined as characters, and the rest are empty.

#### A. Two-byte Chinese-character internal processing code

Using two EBCDIC codes to represent one Chinese character is the optimum formulation for Chinese character internal coding. The common format for 2-byte Chinese character internal coding has already been shown in Figure 2. There are the following several methods for construction 2-byte EBCDIC Chinese character internal coding.



Figure 7. EBCDIC Code Structure

**Key:**

1. Control characters area
2. Graphics character area

**1. EBCDIC Chinese-character coding for all vacant positions**

By choosing 94 unassigned positions from the graphics character area in the EBCDIC coding system to form 94 x 94 Chinese character internal coding, we can conveniently achieve a compatibility of Chinese with foreign languages. But the following points should be observed:

- a. For the selection of empty positions to be acceptable to EBCDIC, the selected positions may not have concealed significance;
- b. It is best to coordinate with the IBM company so that under certain conditions we can be assured that empty positions will not be taken up;
- c. Modifications must be made to certain host software, as for example display software.

**2. The first byte is vacant, the second byte is a character**

For the first byte is chosen a vacant code from the EBCDIC coding system and for the second a defined character code is used, which then constitutes 2-byte Chinese character coding. Actually, the first byte is also used as a Chinese character identifier. To prevent generating ambiguities between the Chinese character internal coded second byte and Western languages, Western language editing and the like could take the two bytes as a unit.

**B. Three-byte Chinese-character internal processing code**

The common format is shown in Figure 5 as well. One can either use independent three bytes or three bytes with a character, where the basic concept is the same as that for 7-byte coding systems but more simple. The identifiers for 3-byte Chinese character internal coding in the EBCDIC

coding system may use a vacant code. Different vacant codes could represent different Chinese-character coded character sets.

#### IV. Chinese-Character Internal Processing Code With Lead-in Symbol

The format for Chinese character internal coding with lead symbols is as shown in Figure 8. Whether this is an ISO 7-bit coding system or the EBCDIC 8-bit coding system, or a dual 8-bit coding system, any of them can make use of Chinese-character lead-in symbols and Chinese-character end symbols to process Chinese-character information. In fact, to add a Chinese-character lead-in symbol to the front of a Chinese-character character string will indicate the beginning of Chinese-character information and the conclusion of Western language information. To add a terminator to the end of a Chinese-character string would indicate the end of Chinese-character information and the beginning of Western text information. Normally, the Chinese-character characters between the Chinese-character lead-in symbol and the Chinese-character terminator are not just one Chinese character but many, and therefore it is actually more troublesome to process a single Chinese character. Consequently, complete compatibility of Chinese and Western languages will appear somewhat less than ideal. If this is wanted, system software will have to be revised.

Chinese-character lead-in symbol	Chinese-character character string	Chinese-character end symbol	Western text character string
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Figure 8. Format for Chinese Character Internal Processing Code With Lead-in Symbol

For the Chinese-character lead-in symbol and the terminator can be used the control characters S0 [0Eh] and S1 [0Fh], respectively. Graphic characters could also be used to represent this. But when using graphic characters the most important things of which to be aware are similar to what we have discussed above regarding the selection of the Chinese-character identifiers.

#### V. Dual 8-Bit Chinese-Character Internal Processing Code

This internal coding uses 16 bits, and the coding space for it is  $16^4 = 65,536$ . But it should be noted that dual 8-bit coding is not necessarily two-byte coding. The bit significance of groups in a byte have been defined as control character areas and graphic character areas, respectively, while Chinese-character internal coding can only use graphic characters and cannot use control characters. The common structure of dual 8-bit code spacing is as shown in Figure 9. According to that, we may have the following three special structures.

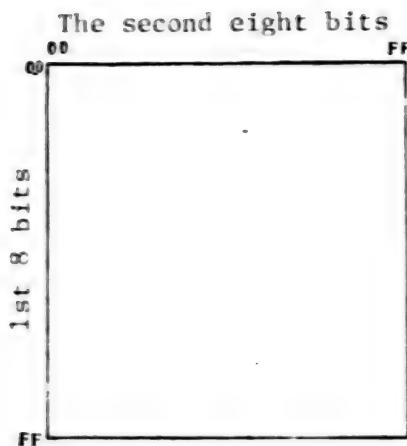


Figure 9. Common Structure for Dual 8-Bit Code Spacing

**A. Dual 8-bit structure that is based on contiguous coding**

Sixteen-bit coding space extends from 0000 to FFFF, where the first 8,192 spaces (0000 1FFF) are for use by alphabet characters, graphic symbols, and control characters. The remaining 57,344 spaces (2000 FFFF) are for use by pictographic characters, and Chinese characters are therefore in this space. By converting the code spaces from 0000 to 0OFF and the existing single-byte 7-bit or 8-bit codes, accommodation can be made for dual 8-bits and single bytes (7-bit or 8-bit), the problem here being that it increases system overhead. Figure 10 shows the contiguously coded dual 8-bit structure.

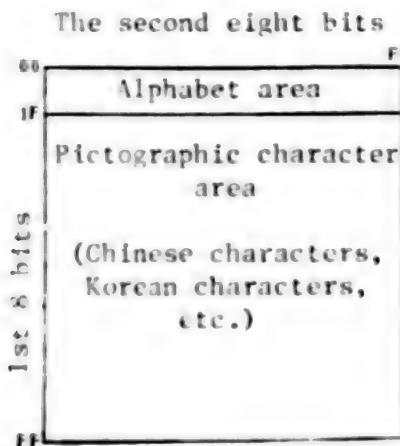


Figure 10. Contiguously Coded Dual 8-Bit Structure

**B. Dual 8-bit structure based on 7-bit coding systems**

In essence, these are the four types of formats shown in the 2-byte Chinese character internal coding of Figure 3, the structure being shown in Figure 11. For relevant coding problems for this, please see the discussion in the second section of this paper. We will not repeat it here.

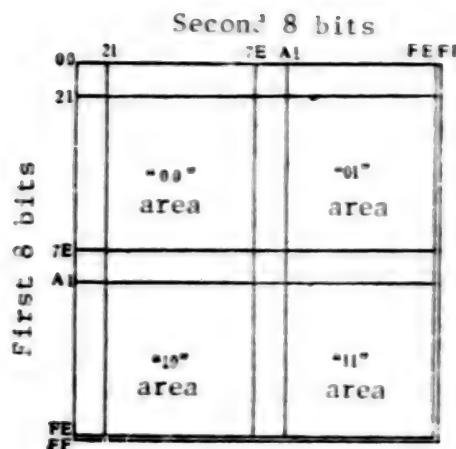


Figure 11. Dual 8-Bit Structural Chart Based on a 7-Bit Coding System

### C. The dual 8-bit structure based on an 8-bit coding system

By this is meant the dual 8-bit structure based on the EBCDIC coding system of Figure 7, and is shown in Figure 12. The only thing worthy of note is that the dual 8-bit Chinese character internal coding of this structure is not easily used directly, and one must also add the use of the aforementioned identifiers or lead-in symbols, and the system software must also be revised.

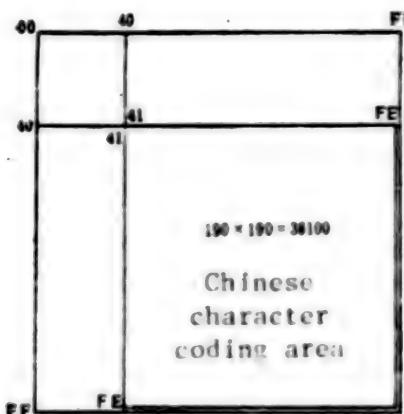


Figure 12. Dual 8-Bit Structure Chart Based on the EBCDIC Coding System

## VI. Coding Text of the National Minorities [2]

For Zhuang text [22, 23] and Miao text, based on the Latin alphabet from A to Z, information processing can be handled directly using existing computer systems, using either the ISO 646 (i.e., GB1988) 7-bit coding system or the EBCDIC 8-bit coding system.

For texts like Mongolian [12], Uygur, Kazak, and Kirgiz [13-16], the sizes of their alphabets exceed 94 (including the basic letters, altered letters,

and composite letters), but are less than 128. If one wishes to directly use existing ISO 646 or EBCDIC single byte coding systems, there must be a merging of the letters and a reduction in the letter data. This needs to be jointly decided between scholars of the spoken and written languages and computer scientists. From the point of view of allowing textual information processing systems for the various national minorities in this country to all accommodate both Western languages and Chinese characters, it is the opinion of the author that it would be best for Mongolian, Uygur, Kazak, and Kirgiz to use the two-byte coding. The International Standards Organization (ISO) is currently actively drawing up a dual 8-bit coding system to seek uniformity for the processing of alphabetic texts and pictographic textual information.

Although Tibetan [17] and Korean texts [18, 19] are alphabetic texts, the number of their characters are in the hundreds and tens of thousands, respectively, so two-byte coding schemes should also be adopted.

Yi text is pictographic text, the number of standardized symbols for which is 819, and there are also a secondary higher modulation symbol and a sound replacement symbol [20, 21], and obviously the two-byte coding would be most appropriate here, too.

## VII. Conclusion

Because of the numerous types of textual characters, as well as the distinction between alphabets and pictographs or their concurrent existence, the software and hardware systems for Chinese textual information processing systems are far more complex than for Western language information processing systems. Implementing the compatibility of Chinese with Western languages and of Chinese characters with the processing of text from the national minorities is currently completely dependent upon the comprehensive design of internal processing code. In China, various specialists and scholars have made many worthwhile contributions to Chinese information processing systems [1], and are currently continuing their contributive efforts at internal process coding to realize compatibility on this large a scale. This paper has done a comprehensive analysis of the various formats for Chinese-character internal coding through 7-bit and 8-bit coding systems, as well as of lead-in symbol Chinese-character internal coding, dual 8-bit Chinese-character internal coding, and textual coding for several national minorities. It also makes several suggestions from the point of view of internal coding structure design for reference to those in this field who are concerned with advances in these efforts and for use early on in Chinese-language information processing systems that are based on computer systems.

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12586/6091  
CSO: 4008/1034

DETAILS OF 'CHANGKONG-1' RPV PRESENTED

Beijing HANGKONG ZHISHI [AEROSPACE KNOWLEDGE MAGAZINE] in Chinese No 1, Jan 87,  
pp 3-4

[Article by Wang Lue [3769 3970]]

[Text] The Nanjing Aeronautical Institute has four departments: the aircraft department, the power engineering department, the department of automatic control, and the department of aerodynamics. It is engaged in the theoretical research of aeronautical sciences as well as in the design of new products. The RPV research office of the Institute has a special team of technical personnel devoted to the research and design of the "Changkong" series RPV's; they also have a strong production capability, with support from the machine shop of the Institute. Development of the RPV's began in the late 60's. The design of the "Changkong-1" high-speed RPV was completed by the Institute at the end of 1976. It is a large, jet-propelled, radio-controlled high-subsonic aircraft. It can be used as a target for missile tests or by air defense units for training exercises. With proper modifications it can be used for monitoring atmospheric pollution, surveying terrain or mining areas, and other applications. The aircraft has a typical high-subsonic design with slender fuselage and large aspect-ratio straight wings; the rectangular horizontal tail is located at the mid-section of the vertical tail; the engine, with its intake duct and engine compartment are suspended below the fuselage. The on-board equipment and the autopilot are installed in the front and rear sections of the fuselage respectively. The mid-section of the fuselage contains the fuel tank, where a pressurized fuel-supply system is used to supply fuel to the engine (see figure).

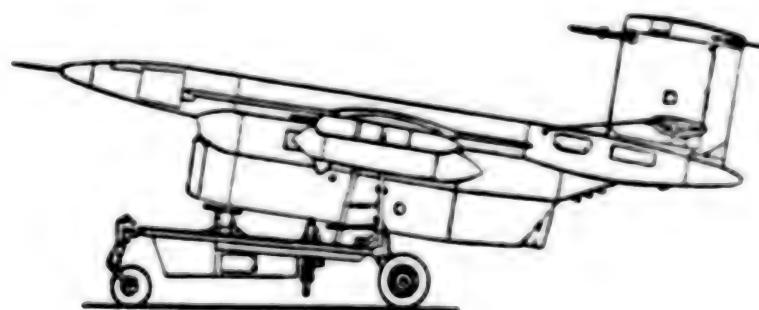


Figure 1

The "Changkong-1" is launched from a retrievable launch trolley. The aircraft is placed on three short guide rails and is secured to the trolley by a thrust pin located at the bottom of the engine. Inside the trolley is an automatic bearing correction system to ensure that the deviation does not exceed 30 meters over the 1,000-meter-long runway. When the velocity reaches 275 km/hr, the cold-gas action tube automatically disengages the thrust pin, and the aircraft separates from the trolley and steadily climbs upward. At the same time, the trolley begins to decelerate, and a radio command is issued to eject the brake chute and apply the brakes until the trolley is completely stopped. It may be reused many times.

After take-off, the aircraft will first be controlled by an on-board computer; subsequently, it will be controlled by radio commands issued by a ground station based on information obtained from the radar screen and other measurements. Each flight is executed according to a pre-designated flight path.

The "Changkong-1" RPV is equipped with a radio communications system which includes the transponder, antenna, high-frequency unit, and receiver/transmitter unit; they are used to receive signals from the ground and to recognize and guide the target aircraft. The remote-control receiver is specially designed to receive commands from the ground station; the receiver-decoder unit can send 24 control commands to the autopilot to other control devices. In order to monitor the operation of the automatic control system and other on-board equipment, the aircraft is also equipped with a radio telemetry system, which uses 52 channels to provide continuous information on flight speed, altitude, angle of attack, engine temperature and rpm to the ground controller.

For stability and control, the RPV is equipped with an autopilot which has four channels: pitch, roll, bearing and altitude; they are used to control the elevator, the aileron, the rudder deflection angle, and the operating condition of the engine. While the channels are independent, they can communicate with one another by sending signals. The main components of the autopilot system include a gyro platform and navigation gyros, a rate gyro unit, a program mechanism, an altitude beacon, an amplifier, a converter and an electric rudder-drive unit. The rudder and elevator mechanisms are located in the rear section of the fuselage, and the aileron control mechanism is contained in the wing.

The primary power source of the aircraft is an engine-driven d.c. generator, which supplies a.c. power to the equipment via the converter. The aircraft also has a silver-zinc battery which can provide back-up power in case of engine failure.

As a target vehicle, the "Changkong-1" RPV can enter the firing zone 2-3 times. To help the ground navigator locate the target vehicle, the aircraft can release a trail of light or smoke. The aircraft is also equipped with a passive radar reflector to enhance its radar cross section and to stimulate the radar image of an "enemy aircraft". If the target vehicle survives its mission, it can be guided back to the landing field by radio command. Upon entering the retrieval zone, the aircraft pulls up at an altitude of 500 m.

then glides downward without power; at touch down, it maintains a large angle of attack so that the tail section will touch the ground first. By relying on the engine compartment and the tail nozzle to absorb part of the impact energy, the main body can be retrieved, and then reused after repair.

The high-mobility "Changkong-1C" RPV was designed based on the B model. The increased mobility requires that the aircraft can perform high-speed maneuvers horizontally or at a large slope of  $70^{\circ}$ - $77^{\circ}$ . This introduces a series of complicated technical problems in aircraft structure, control system, and fuel supply system. Armed with a complete science and engineering curriculum, a special team of researchers, professors and students and production capability, the Nanjing Aeronautical Institute accepted the challenge and completed the design, test and manufacturing of a high-mobility RPV within 1 and half years. The tests include high and low speed wind tunnel tests, simulation tests of various systems both on the ground and in flight, and static strength tests and dynamic response tests of the aircraft structure. The first design modification involves the development of a fuel supply system that can withstand large-slope turns and maneuvers, as shown in the diagram. Specifically, a completely sealed fuel chamber is installed at the forward section of the fuel tank; this chamber is maintained at full fuel level under all flight conditions to ensure continuous supply of fuel. The second design modification involves the development of an automatic control system that can be used in high-mobility flight. Specifically, a roll angle integral signal is introduced in the aileron channel to improve the accuracy of roll control, and to ensure slope symmetry between the left and right sides; also altitude and altitude rate signals are introduced in the elevator channel to improve the dynamic response of the altitude control system and the accuracy of maintaining a stable altitude during level flight. In addition, softening circuits are added to three of the channels to improve balanced control and to achieve good compensation without affecting the original closed-loop performance. In order to avoid overload conditions, measures are taken to reduce the control response to a step change in the elevator channel; in order to prevent sudden drop in altitude, safety measures are taken to provide timely control for terminating a turn maneuver and changing it into level flight or flight with small overload.

Flight test results of the "Changkong-1" series RPV's over the past few years show that the maximum flight altitude ranges from 10,000 m to 18,000 m; the minimum service altitude is 500 m - 5,000 m; the flight speed is between 850 and 910 km/hr; the total range is between 600 and 900 km; the total flight time is 45-60 minutes at low and medium altitudes, and more than 70 minutes at high altitudes. Bank is divided into three levels:  $35^{\circ}$ ,  $60^{\circ}$ , and  $75.5^{\circ}$ , which correspond to regular-mobility, medium-mobility and high-mobility flight respectively. The above information shows that the overall performance indices of the "Changkong-1" series RPV's are comparable to the standards of similar RPV's developed in other countries.

Key dimensions and parameters

wing span	7.5 m
wing area	8.55 m <sup>2</sup>
aspect ratio	6.8
diameter of fuselage	0.55 m
length	8.435 m
height	2.955 m
weight	2,000-2,500 kg

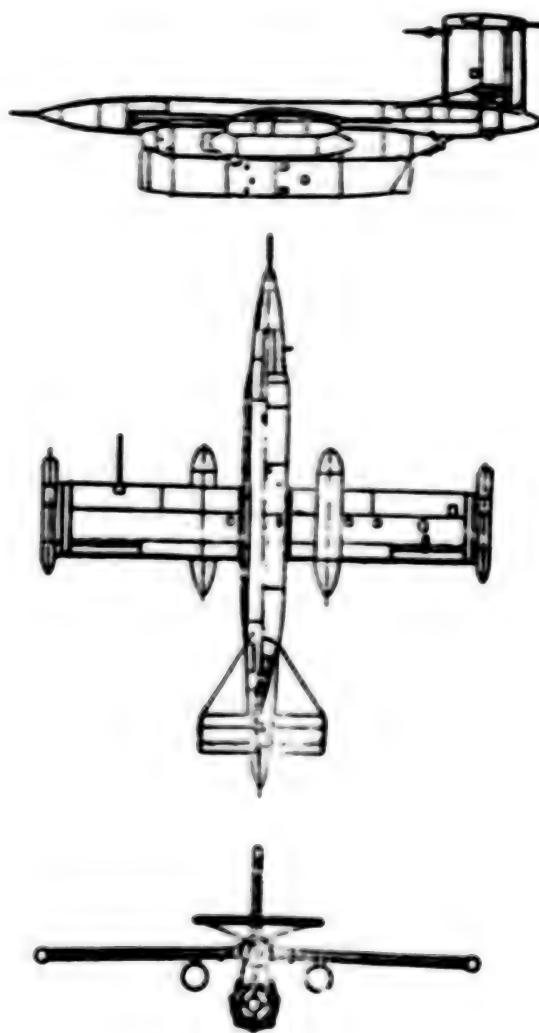


Figure 2

3012/7358  
CSO: 4008/33

GENERATING DIRECTED  $k$ -TREE POLYNOMIAL OF DIRECTED GRAPH BY DIRECTED  $k$ -HYPERTREE

Beijing DIANZI XUEBAO [ACTA ELECTRONICA SINICA] in Chinese Vol. 1, No. 1, Jan 87  
pp 1-9

[English abstract of article by Huang Ruji (7806 3061 3423) of the Department of Automatization, Beijing Institute of Iron and Steel Technology]

[Text] A general method is presented for generating the directed  $k$ -tree polynomial of the directed graph associated to an active electrical network by means of its multi-level vertex tearing and its corresponding directed  $k$ -hypertree polynomial. Using this method, the scale of electrical networks which can be topologically analyzed by a computer will be increased and the resulting expressions terse. Furthermore, for the special case  $k=1$ ,  $e=2$ , the recursive formulas are presented for generating the directed hypertree polynomials of a hypergraph having two hypertrees. Using it, the directed tree polynomial of a directed graph  $G$  can be found conveniently and efficiently. Its expansion gives all directed trees of the graph  $G$ . (Paper received April 1985; revised February 1986.)

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APPLIED SCIENCES

DISPERSION ANALYSIS FOR RING-PLANE SLOW-WAVE CIRCUIT

Beijing DIANZI XUEBAO [ACTA ELECTRONICA SINICA] in Chinese Vol 15 No 1, Jan 87  
pp 40-46

[English abstract of article by Zhal Li [6392 0500] and Hua Yixin [5478 0001  
1800] of Nanjing Institute of Technology]

[Text] The dispersion characteristic of the ring-plane slow-wave circuit for the mm wave TWT is worked out by the variational method. The establishment of the variational equation and its solution are discussed. The numerical calculations are performed on a computer. Theoretical values obtained show good agreement with the experimental results of the authors' cold measurements. This theoretical method can be used for the analysis and design of the ring-plane circuit. (Paper received May 1985; revised September 1985.)

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HIGH PERFORMANCE 8mm FREQUENCY BAND INTEGRATED FRONT-END

Beijing DIANZI XUEBAO [ACTA ELECTRONICA SINICA] in Chinese Vol 15 No 1, Jan 87  
pp 47-51

[English abstract of article by Li Duenfa [2621 2415 1788], et al., of the University of Science and Technology of China]

[Text] The problems of using packaged diodes with large junction areas for millimeter wave integrated mixers are discussed. A cavity stabilized integrated Gunn oscillator is presented and analyzed. A high performance 8mm wave integrated front-end has been developed with a minimum double side band noise figure of 3.6 dB, frequency temperature coefficient of  $3 \times 10^{-6}/\text{C}^\circ$ , spectra line width of 500 Hz and very high shock-resistivity. A few of these units have been produced and are working well in many systems. (Paper received May 1985; revised October 1985.)

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## APPLIED SCIENCES

### PARTITIONED METHOD OF OPTIMIZING EXTRACTION OF MOS3 DC MODEL PARAMETERS

Beijing DIANZI XUEBAO [ACTA ELECTRONICA SINICA] in Chinese Vol 15 No 1, Jan 87 pp 52-59

[English abstract of article by Zhou Hong [0719 4767], et al., of the Institute of Semiconductors, Chinese Academy of Sciences; Yan Zhixin [0917 1807 2450] of Shanghai Science and Technique University]

[Text] A partitioned method of optimizing extraction of MOS3 model parameters for a small MOSFET in the program SPICE-11 G is discussed. The paper includes: input data to be measured, partitioning methodology and optimizing method of model parameters. The method is very simple and its convergence is improved. The differences between measurement and calculation are less than 16 percent. (Paper received March 1985; revised September 1985.)

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## APPLIED SCIENCES

### NUMERICAL ANALYSIS OF COMBINATION MULTIPOLE FIELD-ROTATIONALLY SYMMETRIC FIELD SYSTEMS

Beijing DIANZI XUEBAO [ACTA ELECTRONICA SINICA] in Chinese Vol 15 No 1, Jan 87 pp 68-73

[English abstract of article by Cui Zheng [1508 6927] of Nanjing Institute of Technology]

[Text] The three-dimensional numerical analysis of the combination multipole field-rotationally symmetric field systems is discussed. Some practical methods are presented. A computer program used to analyze the combination systems has been developed. Some novel features of the multipole lens are shown through several examples in which nonsymmetric voltages are applied to the lens. The elementary properties of the system combining a multipole lens with a round lens are studied. (Paper received January 1985; revised October 1985.)

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## APPLIED SCIENCES

### MICROPROCESSOR BASE FOR ACCURATE MEASUREMENT OF DATA NETWORK'S GROUP DELAY

Beijing DIANZI XUEBAO (ACTA ELECTRONICA SINICA) in Chinese Vol 15 No 1, Jan 87 pp 74-77

[English abstract of article by Kong Junbao (1313 0193 1405) of Nanjing Institute of Posts and Telecommunications]

[Text] This paper discusses the method and laboratory models for accurate measurement of group delay distortion in telephone, microwave and trunk networks for data transmission. Loop measurements are discussed. A program-controlled approach using microprocessors is presented, and laboratory models are described and evaluated. The use of a microprocessor results in a low-cost yet accurate and reliable group delay meter. (Paper received April 1985; revised October 1985.)

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## APPLIED SCIENCES

### THEORETICAL ANALYSIS AND CAD OF RADIO ANECHOIC CHAMBER

Beijing DIANZI XUEBAO [ACTA ELECTRONICA SINICA] in Chinese Vol 15 No 1, Jan 87 pp 84-89

[English abstract of article by Zhang Xuexia [1728 7185 7209], et al., of the Radio Electronics Department, Qinghua University, Beijing]

[Text] An approach to obtain a variety of information on radio anechoic chambers is presented. Based on geometric optics, the representation of fields in the radio chamber in a three-dimensional case is derived, from which the reflectivity and cross polarization coefficient concerning both the transmitter and receiver antenna patterns can be obtained. In addition, according to the region of the transmitting and receiving points, the position of the reflected zone on each of the six walls is sought out. Consequently the arrangement of the absorbers on each wall can be selected and arranged to be more reasonable and economical. The numerical and graphic results are given. (Paper received January 1985; revised June 1986.)

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## APPLIED SCIENCES

### GENERALIZED ALLAN VARIANCE AND MODIFIED ALLAN VARIANCE

Beijing DIANZI XUEBAO [ACTA ELECTRONICA SINICA] in Chinese Vol 15 No 1, Jan 87 pp 90-97

[English abstract of article by Tang Su [0781 4790], et al., of Chengdu Institute of Radio Engineering]

[Text] Frequency stability is studied using the stochastic signal processing theory and a new variance definition in the time domain, the Generalized Allan Variance  $\sigma_{p,q}^2(T)$ , is given. It is proved that the variances, including the Allan Variance and the Modified Allan Variance, are all special cases of  $\sigma_{p,q}^2(T)$ . For power law spectral noises, the signal processing models for calculating  $\sigma_{p,q}^2(T)$  from  $S_Y(f)$  and its calculation formulas are obtained, the conversion formulas between  $\sigma_{j,2}^2(T)$  and  $S_Y(f)$  are derived, the calculation formulas of the other variances in the time domain from  $\sigma_{j,2}^2(T)$  are given and the conversion between  $S_Y(f)$  and  $\sigma_{p,q}^2(T)$  can be made easily. The formulas of  $\sigma_{j,2}^2(T)$  by computer simulation are verified. (Paper received March 1985; revised August 1985.)

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## APPLIED SCIENCES

### METHOD FOR REALIZATION OF RC TWO-PORT NETWORKS

Beijing DIANZI XUEBAO [ACTA ELECTRONICA SINICA] in Chinese Vol 15 No 1, Jan 87 pp 119-123

[English abstract of article by Liu Bin [0491 1755] of Northeast Heavy Machinery Institute]

[Text] The root locus of control theory is applied to network synthesis. A criterion theorem of the R-type function is presented, and a new method is given for designing RC two-port networks connecting the arbitrary RL loads at the output terminal. The realization problem of the transfer function is thus solved, with the poles on any arbitrary position on the left half of the S face, and the number of elements used for the realization network is reduced. (Paper received January 1985; revised June 1985.)

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STUDY OF FIELD EFFECT UNDER ILLUMINATION FOR Cd-a-Si<sub>x</sub>C<sub>1-x</sub>:H FILMS

Beijing DIANZI XUEBAO [ACTA ELECTRONICA SINICA] in Chinese Vol 15 No 1, Jan 87 pp 124-126

[English abstract of article by Wang Yinyue [3769 0603 2588], et al., of the Department of Physics, Lanzhou University]

[Text] The field effect of Cd-a-Si<sub>x</sub>C<sub>1-x</sub>:H films under illumination and photoconduction as well as the S-W effect is studied using the MOSFET structure. The measurement results show that the density of states due to illumination is about 10<sup>17</sup>/cm<sup>3</sup>·eV. (Paper received June 1985; revised January 1986.)

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9717

CSO: 4009/1076

APPLIED SCIENCES

SIMFLE DIRECT METHOD OF MEASURING SMALL ENERGY SHIFT AND WEAK LINES FOR  
MÖSSBAUER SPECTROSCOPY

Shanghai HE JISHU [NUCLEAR TECHNIQUES] in Chinese No 11, Nov 86 pp 11-15, 58

[English abstract of article by Hu Wenxiang [5170 2429 4382], et al., of  
Shanghai Institute of Nuclear Research, Chinese Academy of Sciences]

[Text] A simple method combining Mössbauer dispersion with a resonance filter for measuring small energy shifts and weak lines is described. The small energy shift (0.01 mm/s) and weak components (less than 5 vol PC a phase) can be directly obtained from the Mössbauer dispersion method of absorption compensated to scatter with different thicknesses of the absorber. This method is suitable for Mössbauer measurements of multiphase steel samples.

APPLIED SCIENCES

SIMPLE GAS TRANSPORT SYSTEM USED IN DECAY STUDY OF SHORT-LIVED NUCLEI

Shanghai HE JISHU [NUCLEAR TECHNIQUES] in Chinese No 11, Nov 86 pp 21-22, 58

[English abstract of article by Xiao Genlai [5135 2704 0171], et al., of Shanghai Institute of Nuclear Research, Chinese Academy of Sciences]

[Text] A simple gas transport system is described. Air is used as the medium to take out gas radioactivity through a capillary to the gas collecting chamber. It is then measured by a Ge(Li) detector. The system, combined with a  $\gamma$ -ray multispectra analysis technique, is used to study  $\gamma$ -ray energy, relative intensities and half lifetimes of gas radioisotopes produced by nuclear reactions.

From the  $\gamma$ -ray multispectra of the  $^{23}\text{Ne}$  isotope produced by the reaction  $^{23}\text{Na}(\text{n},\text{p})^{23}\text{Ne}$ , the half-life of  $37.3 \pm 0.7$  s and  $\gamma$ -ray energies of  $^{23}\text{Ne}$  have been determined. The results are quite consistent with the values reported in the literature.

HIGH RESOLUTION HPGe DETECTOR AND ITS STABILITY

Shanghai HE JISHU [NUCLEAR TECHNIQUES] in Chinese No 11, Nov 86 pp 28-30, 59

[English abstract of article by Wang Guogan [3769 0948 1626], et al., of Shanghai Institute of Nuclear Research, Chinese Academy of Sciences]

[Text] After the HPGe detector has been stored at room temperature for 1056 hours and has been circulated 15 times from room temperature to liquid nitrogen temperature, its performances are still excellent. FWHM of 169.1 eV and 408 eV are obtained for  $^{55}\text{Fe}$  (5.9 keV) and  $^{241}\text{Am}$  (59.5 keV), respectively.

RADIATION-INDUCED CROSSLINKING OF POLYMETHYL METHACRYLATE

Shanghai HE JISHU [NUCLEAR TECHNIQUES] in Chinese No 11, Nov 86 pp 43-45, 62

[English abstract of article by Ye Lianghua [0673 5328 5478], et al., of Shanghai Institute of Nuclear Research, Chinese Academy of Sciences]

[Text] In order to improve the properties of plexiglass and develop new products, the possibility of preparing crosslinking polymethyl methacrylate has been attempted. Three methods have been carried out:

1. Methyl methacrylate was polymerized in bulk at room temperature.
2. Radiation polymerization of methyl methacrylate in the supercooled liquid phase between -20 and -10°C was observed.
3. Under certain experimental conditions, highly crosslinked polymethyl methacrylate was formed. A crosslinked polymer of  $M_c = 2 \times 10^4$  means that the linear polymer with a molecular weight of  $2 \times 10^6$  has 100 crosslinking points.

The measurement of  $M_c$ , the average molecular weight between crosslinks, has been established by measuring the swelling capacity of crosslinking polymethyl methacrylate.

APPLIED SCIENCES

ALANINE FREE RADICAL DOSIMETER

Shanghai HE JISHU [NUCLEAR TECHNIQUES] in Chinese No 11, Nov 86 pp 49-50, 20, 63

[English abstract of article by Song Jianmin [1345 0256 3046] of the Institute of Biophysics, Chinese Academy of Sciences]

[Text] There are few dosimeters with the dose range suitable for radiation processing. This paper describes the alanine free radical dosimeter by chemical read-out. The irradiation alanine (50 mg) are dissolved in 10 ml of the solution containing 0.20 mmol/l ferrous sulphate and 0.20 mmol/l xylene orange in 0.025 mol/l sulphuric acid (FX). The absorbance of the ferric-xylene orange complex in the presence of alanine is measured at 540-550 nm. Doses ranging from 200 Gy to 10 kGy can be measured. The dosimeter is quite stable for about one year after the irradiation. The technique is simple and accurate, with very good results.

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CSO: 4009/20

## ENVIRONMENTAL QUALITY

### SERIOUS POLLUTION REPORTED IN ZHU JIANG DELTA

HK160427 Hong Kong ZHONGGUO TONGXUN SHE in Chinese 1442 GMT 12 Jan 87

[Text] Hong Kong, 12 Jan (ZHONGGUO TONGXUN SHE)--According to a news report from Guangzhou, there is serious environmental pollution in the rural areas of the Zhu Jiang Delta where township enterprises are developing vigorously. The department concerned is working out measures to solve the problem.

The fact that large numbers of township enterprises are constructed without antipollution or pollution-removal facilities is the main cause of polluted rural areas in the Zhu Jiang Delta. Electroplating, exposure-etching and cement factories, which are all highly pollutant, constitute the greatest proportion of township enterprises. According to statistics, in a Taishan County district alone, there are more than 80 electroplating and exposure-etching factories located separately in rural areas and market towns. They have seriously polluted the area. In Nanhai County there are nearly 100 electroplating factories without any antipollution facilities. They each discharge 5 tons of copper elements and nitrides a year into small and big rivers. Small and large-sized cement factories in the county discharge 14,000 tons or more of dust a year. Xiaolan District in Zhongshan City has 17 electroplating factories which discharge 240,000 tons of electroplating waste water every year.

Rivers in the delta region are most seriously polluted. A total of 20 million tons of industrial waste water is discharged into the Fen He at Foshan every year. Last year the volume of river water oxygen consumed by chemicals was 10.7 mm per liter, nearly 100 percent higher than state standards. A total of more than 150 million tons of industrial waste water is discharged every year in the five counties under the jurisdiction of the Jiangmen City Government. Of this, the total up to state discharging standards accounted for just 67 million tons or so.

Air pollution is becoming increasingly serious. The average amount of dust in the city proper in Foshan has increased from the 8 tons or so per cubic kilometer a month during the previous 5 years, to 11 tons or so. The waste gas discharged by the five counties under Jiangmen City's jurisdiction, as well as Yangjiang and Yangchun Counties, amounts to 17.5 billion cubic meters a year, comprising more than one-fifth of the province's total.

**Pollution has brought serious consequences. In recent years, the silkworm survival rate in the Zhu Jiang Delta has greatly deteriorated. This is also one of the reasons for the considerably reduced number of mulberry-based fish ponds. In recent years the incidence of malignant tumor in Jiangmen City's five counties has increased considerably. The lung cancer mortality rate in the counties is higher than that of such northern industrial cities as Beijing, Shanghai, Shenyang, and Taiyuan.**

**Zhuhai City, located at the southernmost tip of the delta region, is an exceptional "piece of clean land." Since the city, which is located close to the seashore, does not have any polluting factories, its average amount of dust is 2 to 3 tons per cubic kilometer a month. The atmospheric environment and the reservoir water quality in the city have reached the state Grade-1 standard and they are even better than those of tourist cities, such as Guilin and Hangzhou.**

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